DOCUMENT RESUME

ED 129 414 PS 008 789

TITLE	Kansas Center for Research in Early Childhood Education Annual Report, FY 1972. Vol. II of II.
INSTITUTION	Kansas Univ., Lawrence. Kansas Center for Research in Early Childhood Education.
SPONS AGENCY	National Coordination Center for Early Childhood Education, St. Ann, Mo.; National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	Dec 72
CONTRACT	OEC-0-70-4152-607; OEC-3-7-070706-3118
NOTE	351p.; Filmed from best available copy; 4 pages of original document are copyrighted and therefore not available. They are not included in the pagination; For Vol. I, see PS 008 788; For Annual Report, FY 1973, see PS 008 787
EDRS PRICE	MF-$0.83 HC-$19.41 Plus Postage.
DESCRIPTORS	Abstraction Tests; *Abstract Reasoning; *Early Childhood Education; Elementary Education; Elementary School Students; Oral Reading; *Paraprofessional School Personnel; Performance; Preschool Children; Preschool Education; Programed Instruction; Reading Comprehension; Reading Materials; *Reading Readiness; Reading Skills; *Remedial Reading Programs; *Research; Response Mode; Stimulus Behavior; Supervisory Methods; Tests; *Tutors; Verbal Ability; Visual Discrimination
IDENTIFIERS	CEMREL; Central Midwestern Regional Educational Laboratory; Mirror Image

ABSTRACT

This volume includes reports of two research projects of the Kansas Center for Research in Early Childhood Education. The first project, entitled Individual Analysis of Reading Prerequisites and Curriculum Content, is represented by two studies: (1) A Study of a Pretraining Program and Its Effect on a Subsequent Program for a Left-Right Discrimination, and (2) Three-Dimensional Programming of Simple and Complex Relational Abstractions. The second project, entitled Studies of Instructional Methods and Techniques in Remedial Reading, includes studies on (1) Supervising Paraprofessionals--Performance Related Feedback, (2) Remedial Reading: A Program Conducted in an Elementary School Utilizing Paraprofessional Tutors, (3) Paraprofessionals Tutoring Reading, (4) The Juniper Gardens Reading Program, and (5) The Juniper Gardens Manual for Establishing and Maintaining a Remedial Reading Program. (BF)

Documents acquired by ERIC include many informal unpublished materials not available from other sources. ERIC makes every effort to obtain the best copy available. Nevertheless, items of marginal reproducibility are often encountered and this affects the quality of the microfiche and hardcopy reproductions ERIC makes available via the ERIC Document Reproduction Service (EDRS). EDRS is not responsible for the quality of the original document. Reproductions supplied by EDRS are the best that can be made from the original.

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED129414

UNIVERSITY OF KANSAS

RECEIVED
MAR 5 1973
NATIONAL COORDINATION CENTER

FY 1972

ANNUAL REPORT

VOL. II OF II

KCRECE

**KANSAS CENTER FOR RESEARCH
IN EARLY CHILDHOOD EDUCATION**

PS 008789

FY 1972

Annual Report

THE KANSAS CENTER
FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Department of Human Development

University of Kansas

John C. Wright

Director

Volume II

TABLE OF CONTENTS

Volume II of II

Project 3BOK05	Individual Analysis of Reading Prerequisites and Curriculum Content	Etzel - LeBlanc
Project 4BOK08	Studies of Instructional Methods and Techniques in Remedial Reading	Wolf - Christopherson

TABLE OF CONTENTS

Volume I of II

Project 1HOK04	Individual Differences in Newborn and Young Infants	Horowitz
Project 1HOK01	Development of Social Competence	Rosenfeld
Project 3HOK03	Attention and Cognitive Styles	Wright
Project 4BOK06	The Development of Generative Language in Retarded Children	Sherman
Project 1HOK10	Infant Day Care Research	Risley

NOTE:

Prepared under the auspices of CEMREL, Inc., a private nonprofit corporation supported in part as an educational laboratory by funds from the National Institute of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the National Institute of Education, and no official endorsement should be inferred.

FY 1972

December, 1972

Project: Individual Analysis of Reading Prerequisites and Curriculum Content

Project Code #: 3BOK05

Principal Investigators: Barbara C. Etzel
Judith LeBlanc

Contents of this report:

K05-5 Program Report

K05-6 A Study of a Pretraining Program and Its Effect on a Subsequent Program for a Left-Right Discrimination

K05-7 Three Dimensional Programming of Simple and Complex Relational Abstractions

KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Project Code #3BOK05

Principal Investigators:

Barbara C. Etzel
Judith LeBlanc

PROGRAM REPORT

The final report for Project Code No. 3BOK05-6 concerning the programming of academic behaviors in non-reading children is in progress. This report will be bound and sent separately from this Annual Report when it is available.

A STUDY OF A PRETRAINING PROGRAM AND ITS EFFECT ON A SUBSEQUENT PROGRAM FOR A LEFT-RIGHT DISCRIMINATION[1]

by

Barbara C. Etzel and Nancy W. Bybel

KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Final Progress Report

December, 1972

Distribution or quotation of
any portion of this paper
must be with the permission
of the Authors.

Program 2
Component D
Project 3BOK05-1

INTRODUCTION

The discrimination of a variety of paired mirror image stimuli has been studied by experimental psychologists for some time. Infrahuman animals, preschool children, retarded children and normal and abnormal adults have all been subjects. Interest in using mirror image stimuli with these different subject groups has resulted from a wide variety of different research questions being asked concerning discrimination processes.

For example, Jeffrey (1958) observed that many four-year-olds did not easily acquire a left-right oriented (mirror image) discrimination between two simple stimuli. By adding a motor response to the child's repertoire prior to the final criterion response, he was able to significantly increase the proportion of children that acquired the discrimination. The use of this procedure by Jeffrey was a result of his interest in the area of mediational theory of human conceptual development; in this case mediated discrimination.

Bijou (1968) also used mirror image stimuli in a study that investigated fading and stimulus shaping procedures to achieve near errorless discrimination acquisition. His interest was in investigating programming procedures that would result in very few or no errors during the acquisition of a difficult discrimination.

Although both of the above experimenters used mirror image stimuli in their studies, neither was primarily interested in the study of the stimuli per se. Rather, it would appear that both used the stimuli because they tend to produce high error rates in preschool and retarded children. Subjects tend to respond to the mirror image match as frequently as to the direct (same) match of a sample stimulus.

A "good" test of a teaching procedure would then be to observe how successful it was in reducing these mirror image matches. Thus, observing how subjects acquire a difficult discrimination under different training conditions may separate mediocre from highly successful procedures.

Both the Bijou and Jeffrey studies represent two areas of child development that have been of interest to experimenters for some years. In several studies where a verbal or motor (such as in the Jeffrey study) response was added to a chain that culminated in the final criterion response, the acquisition or recall of a discrimination was facilitated (Hagen and Kingsley, 1968; Lovitt and Curtiss, 1968; Weir and Stevenson, 1959). Another series of studies has also investigated the advantages of adding a verbal response to the subject's repertoire. However, instead of requiring it during the learning process, as in the studies previously mentioned, it is trained separately and before the training on a final discrimination or transfer task (Cantor, 1955; Norcross and Spiker, 1962; Shepard, 1956).

A more recent series of investigations on teaching procedures used in errorless stimulus control studies have begun to suggest that a technology may be developed whereby precise control of responding is possible through the arrangement of stimuli. Bijou (1968), Sidman and Stoddard (1967), Moore and Goldiamond (1964), and Touchette (1968) have demonstrated that fading, superimposition and stimulus shaping procedures applied to stimuli in the child's learning environment will facilitate the acquisition process.

The studies that have used programing or errorless stimulus control procedures have been by scientists who usually accept the more empirical, operant or behavioral approach to the study of psychological questions. They would not ascribe to the proposition that errors are necessary (i.e., the subject must respond to the S-) in order for acquisition to occur.

The psychologists who have studied the effects of verbal pretraining or the effects of added motor or verbal responses during the acquisition process are usually more theoretical in their orientation. With the help of intervening variables they attempt to explain S-R acquisition through inhibition (the result of no reward when S- is responded to) and other processes.

The theoretical (or lack of it) approach to the study of learning by these two groups results in rather different procedures being investigated when acquisition is under consideration. In general, there has been no series of studies published whereby both procedures have been combined to aid in the acquisition of conceptual problems. "Programers" often think in terms of lengthy series of programs, each independent, yet building upon one another to accomplish some desired criterion behavior. Trial and error psychologists on the other hand tend to use simple, little training procedures that cut down to some extent the lengthy trial and error process usually needed to obtain acquisition.

The present study is an outgrowth of an investigation (Werner, 1971) that resulted in a program for teaching a lower case b - d discrimination to preschool children. This is a very difficult discrimination to learn for this age subject and furthermore is an example of the mirror image problem if the d is present as a possible match when b is the sample stimulus in a match-to-sample format (and vice versa).

Werner's program was most successful when she added a verbal response (in a chain of responding) before the final criterion response of pointing to two stimuli (ex. the sample 'b' and the match 'b') when one of the other matches was a 'd'. The program utilized a variety of fading and stimulus shaping procedures. Although the program was fairly successful for a random group of children chosen for study, there were still some difficulties when the verbal label was being taught during the program. Attending to the "rule-of-thumb" of not teaching two things at once when programing, it was decided that a pretraining program could be developed that taught the verbal response to the child prior to the b and d programs.

The present study was therefore primarily concerned with investigating procedures that would teach a difficult mirror image discrimination to preschoolers. Of interest also was the study of the effect of a programmed pretraining procedure. The procedures involved a verbal response to be acquired prior to the acquisition of a visual discrimination. Variations of these two acquisition processes were also carried out and compared.

METHOD

Subjects

Eighteen children who ranged in age from 3-yrs 3-months to 6-yrs 6-months were identified through pretests to be responding at chance level on a b-d (lower case) match-to-sample discrimination problem. They attended the Edna A. Hill Child Development Preschool Laboratories in the Department of Human Development at the University of Kansas. The study was conducted in an experimental room near the preschool classrooms. The daily sessions lasted between five and thirteen minutes and the total experiment for any one child took 17 days. After receiving two days of pretests, the subjects were placed in four groups on the basis of their pretest scores, their ages, and sex. The four groups were arranged so that each group's mean or ratio was as similar as possible to the other three groups. The mean ages; the distribution of the male/female ratios; and the average of the two pretests for each of the four groups are found in Table 1.

Insert Table 1 About Here

Design

The four groups studied in this design were created from what occurred during both the preliminary labeling (story) program and the subsequent b and d programs. Two of the groups had only to sit (and hopefully "listen") while the story was read to them. The other two groups had to point upon the experimenter's request to each one of the stimuli (characters in the story) about whom the story was being read. One of these two groups also had the additional requirement of emitting a verbal refrain prior to pointing that included the names of the characters in the story. The subjects were also divided into two groups according to what was arranged for them on the b and d programs which followed the story. One group (required verbalization) was required to label either the b or the d (depending on which was being programmed at the moment) when the pointing response was also made to the sample or match stimulus. The other group did not label the stimuli, and simply pointed to the sample and matches. The effects of these various conditions were analyzed by comparing pre-post and probe tests across acquisition for the following four groups:

	Story Program	b and d program
1.	verbal refrain	required verbalization
2.	sit	required verbalization
3.	sit	no-required verbalization
4.	point	no-required verbalization

The sequence of events for each of the four groups across all tests and programs is summarized in Table II.

Insert Table II About Here

Both group (trend analysis) and individual analyses (subject curves) were possible from the data due to the use of repeated probes (same as pre and posttests) during the acquisition process. Subject performance during programs was also collected and graphed by group and individual means.

Apparatus

A TMI GROLIER Min/Max II teaching machine which the subjects were trained to operate themselves was used for all sessions except when the story was read. The machine was altered so the window through which the stimuli were displayed was increased by one inch vertically. The machine was placed to the left of the experimenter and directly in front of the child on a small table.

Materials

Pretest - Probes - Posttest

All tests consisted of 12 items that required a lower case b and d discrimination. Each item was presented in a match-to-sample format. The letters were typed in primary type size. Six b's and six d's were presented as samples and randomly distributed across trials. When the correct match was a b, one of the two distractors was a d and vice versa. The other letters used as distractors were p, g, i, e, and c. The position of the correct choice was varied so each horizontal position was correct an equal number of times. The pre-post and probe tests had two formats. One was simply the reverse order of item presentation of the other. The two forms were used to avoid any subject memorizing a pattern of correct responses. One of the forms of the test is included in Appendix A.

Story Program:

Story program (verbal refrain group)

Subjects were introduced to two refrains, each being associated with a particular character in the story. When the experimenter read about a character, the subjects were required to verbalize the refrain at a specified time while pointing to the character.

The pages on which the characters appeared (always one per page) were randomized so that one character did not always appear on the same side of a page. Also the page on which the subject was first required to look was not always on the left. This procedure was implemented so that the subject might tend to look at the characters on both the left and the right pages before a pointing response was made.

Incorrect pointing responses to a character were corrected. The correction procedure involved telling the subject which one was correct by saying, "This is the one." A 90% criterion for receiving the toy was used each day.

Story program (point-no-refrain group)

This group had the same materials, correction procedure and criterion for reinforcement as the verbal refrain group. However, they were not required to emit the verbal refrain which was read to them; they were only required to point.

Story program (sit group)

These subjects were told to sit quietly in the chair while the story was read. They were not required to emit the verbal refrain or point while looking at the pictures. They were told if they sat quietly they would receive their toy at the end of the session.

The pictures used in the story, the story prose and the data sheet are included in Appendix B. Each numbered item refers to one picture (except where noted on the data sheet). The verbal refrains for the pictures were: "Uh huh," says Mother Duh; and "Wee gee," says Bonghy-Bee.

b program

This program presented b as the sample stimulus throughout the 45 items. The position of the correct choice was randomized appearing in the three positions an equal number of times. One distractor was d and the other was a made-up figure. A criterion of 90% was in effect to receive a toy. A correction procedure was used for each incorrect response by telling the subject the correct response. Program b and the data sheet can be found in Appendix C.

d program

The sample stimulus was d throughout the 45 items of this program. One distractor was b and the other was the same made-up figure used in the b program. The correct choices were random as in the b program. The criterion and correction procedure were also the same. The d program is also included in Appendix C.

Combination program

This program was the first time, on other than all tests, that both b and d items were interchanged and used as sample stimuli. The randomization, correction procedure, distractors, instruction and criterion were the same as on the two previous programs. The combination program items are found in Appendix D (only the b program is shown).

Recall of verbal label

The recall of verbal label consisted of five lower case b's and five lower case d's individually and randomly presented. Each was of primary type in the middle of a card. The order of occurrence of the single b and d letters used for the recall of verbal labels is found in Appendix E. Incorrect responses were corrected by the experimenter telling the subject what the correct stimulus was.

Procedure

Pretest

Each subject was given two days of pretests. The second day's items were the first day's in reverse. On the first item of the first day, the subject was instructed to "Point to this one," with the experimenter indicating the sample with her right index finger under the sample. The subject was then instructed to, "Find another one like it over here" while the experimenter ran her finger along the top of the match choices and landed above the correct choice. In this manner, the subject was cued as to the response required of him. The instructions for the remainder of the pretest were identical with no cues from the experimenter. Each correct response was followed by a token and praise.

When a subject made an incorrect choice, the experimenter made some comment such as, "That was a good try," or "That's fine," but no token was delivered. There was no correction procedure. A criterion of 50% correct on the pretest was used for each subject to receive the toy he had chosen before the session. The experimenter determined what 50% would be before each session and placed that number of tokens in her cup. The subject was informed at the beginning of each session that he needed to get all of the tokens from the experimenter's cup to his cup to get the toy. He received a red token if he scored less than 50% and the toy was placed aside to be worked for at the next session. The data sheet is shown at the end of Appendix A.

Story

A story which took 5 sessions was then read to all subjects following the pretest. The story was in an 11½ in. x 10½ in. hardback notebook. After the characters in the story were introduced, a fading procedure was begun. The complexity as well as the height of the characters were faded. They were 8½ in. (Mother Duh) and 8 in. (Bonghy-Bee) in height at the beginning of the story and 3/4 in. at the end.

The character Mother Duh was introduced on the first item. The name of Mother Duh was chosen for the stimulus character which was to become a d at the end of the d program. The short phonetic sound of the letter was chosen to contrast with Bonghy-Bee. The story told about the things Mother Duh and her baby like to do. On the fourth item, the second character, Bonghy-Bee, was introduced. The name Bonghy-Bee was chosen for the stimulus character which became a b at the end of the b program. The name is longer than Duh and has the name instead of sound of the letter. Since "bee" and "dee" sound alike, it is quite possible that this adds to the difficulty some children have in discriminating the visual b from the d. Therefore, the "bee" and "dee" sounds were made as different as possible. The short phonetic sound duh of the d and the name "bee" of the b were used to help accomplish this. In addition, the word "Bonghy" was used to add to the length of the "bee" verbalization. The magic bong stick of Bonghy-Bee's that could make things disappear and re-appear was also introduced. This was the main theme of the story. On the sixth item, the way the magic bong stick worked its magic was introduced when a bush disappeared. Items seven through ten saw Mother Duh's hat and ears and Bonghy-Bee's stomach and hands had disappeared. The fading on Mother Duh began from the top with her hat and moved down while the fading on Bonghy-Bee started in the middle and moved out. This was done to keep the fading on the two as different as possible.

There was more fading of the complexity of the characters on the second day of the story. Mother Duh's nose, eyes, head, arm, hand, purse and tail faded. Bonghy-Bee's legs, arams and feet faded. When one character appeared twice on two pages which were facing each other, as in items 17 and 18, the experimenter cued which picture to point to by putting her finger on that page.

Items 21 through 30 comprised the third day. Bonghy-Bee's collar, his other arm, hat, eyes and nose were faded. Mother Duh's other arm and hand, chest, feet and legs faded as well as Baby Duh's ears and hands.

On the fourth day, items 31 through 40, Baby Duh's eyes and mouth, plus Baby Duh and Mother Duh's pouch faded. Bonghy-Bee's ears, hair and mouth and head faded. The complexity of the characters was completely faded by item 36. On item 37, Mother Duh appeared as she had at the beginning of the story as did Bonghy-Bee on item 38. They both appeared, on items 39 and 40, with the complexity faded completely as they had on 35 and 36.

Fading of the size of the character was begun and completed on the fifth and last day of the story. They were faded by 2½ in., 1½ in., 3/4 in., 3/4 in., 1 in., ½ in., ½ in., ½ in., and ¼ in. until they were 3/4 in. in height, the same as they would be at the beginning of the b and d programs. The story ended with the characters appearing as they had at the beginning, before any fading had occurred. This was done to make the adults reading it happier.

Required verbalization group

The refrain associated with the character Mother Duh was introduced on the first item of the first day of the story. After the experimenter had said the refrain, she told each subject in this group to help her say the refrain. After it was practiced several times together, item two was presented. The experimenter cued each subject when to say the refrain on this item by saying, "Now you say it with me." The experimenter faded her help on the refrain by fading her voice softer. Each subject was required to verbalize the refrain of " 'Uh huh' says Mother Duh" at the end of each item in the story associated with Mother Duh while pointing to the character. (See items marked with an asterisk on day one of the story data sheet at the end of Appendix B.)

On day two of the story, the refrain associated with Bonghy-Bee was required. It was introduced (the experimenter verbalized it aloud, herself) on day one but not required until day two. The refrain associated with Mother Duh was not required on day two while the subjects were learning the new refrain. The same practice to get the subjects to say the refrain was used. The refrain of " 'Wee gee' says Bonghy-Bee," which was said while pointing, was then required on the items marked with an asterisk on day two of the story data sheet which is in Appendix B.

Both refrains were required on days three and four. On day five (items 41 through 50), the experimenter pointed to the character Mother Duh and said, "Say Duh." While pointing to Bonghy-Bee, she said, "Say Bonghy-Bee." Therefore, the subjects said the names as they pointed to the character that was indicated by the experimenter. This was done so that the pointing and naming of the stimuli would be similar to the procedure used in the b and d programs.

At the beginning of each story session, the experimenter asked each subject if he remembered Bonghy-Bee, Mother Duh and Baby Duh and the game they were playing. This was done to be sure the child was ready to begin the session.

No-required verbalization group

For this group, when the experimenter told them to point to a specified character, they were required to do so. Ultimately the experimenter faded the request to point and each child initiated on his own. The experimenter said the refrain throughout the story.

Sit group

The story was read the same way it was for the no-required verbalization group but no pointing to either character was requested. The only requirement of these subjects was to sit in the chair while the story was read.

Probe one

In the session following completion of the story the first probe was given. This was the same test as day one of the pretest. No verbal labels were required. The subjects were given the same instructions as were used on the pretest and the 50% criterion to receive a toy was also the same.

b or d program

Half of the required verbalization group and half of the no-required verbalization group was given the b program first while the other half was given the d program. Each program took two sessions with 45 items in a program.

At the beginning of both programs, each subject was asked whether the sample was Bonghy-Bee or Duh. They were then instructed to, "Point to this one," while the experimenter also pointed to the sample, and then to, "Find another one like it." A criterion of 90% correct was used each day to receive the toy.

Required verbalization group

These subjects were required to point to the sample and say either Duh or Bonghy-Bee (depending on the program) and then find the correct match and also verbalize.

No-required verbalization group

These subjects were not required to verbalize but to only point to the sample and the correct match stimulus.

b program

The b was presented in the first item as it appeared at the end of the story, 3/4 in. high and one in. wide. On items two through five, the distractors were brought in completely. The width of the b stimulus was faded by 1/8 in. on items 6 through 16. Item 16 presented the sample as a 3/4 in. lower case b. The height was faded by 1/8 in. on items 17 through 26. The correct stimulus was then the size of primary type and the d distractor faded on items 27 through 37. The position of the sample was then gradually moved from the center to the left side and down to the same horizontal line as the match stimuli on items 38 through 43. The final 2 items were criterion behavior with the match-to-sample format, the same as in the pretest. Pilot research in an earlier study (Werner, 1971) had indicated that an abrupt shift from a vertical format (where the sample is situated above the matches and in the middle) to a horizontal format (the sample is located to the left clearly separated from the matches but on the same plane) on the match-to-sample would result in increased errors. Also, even though the vertical format appeared to be easier for children[2], it was decided that the "best test" of a training procedure would be to require the criterion behavior under the more difficult arrangement of the stimuli. Consequently, it was thought appropriate to train under the simpler vertical arrangement and then when acquisition had occurred to this point, slowly shift to the horizontal format.

d program

The d program which used a different fading procedure also began as the stimulus appeared at the end of the story, 3/4 in. high and ½ in.

wide. The distractors were faded in from items 2 through 11. Beginning on item 12 and ending on item 17, the stimuli were faded by 1/8 in. They were faded by 1/16 in. on items 18 through 25. The b distractor was then faded to a lower case b on items 26 through 31. The rounded portion of the d stimuli was then closed on items 32 through 37. The sample stimulus then moved gradually to the left on items 38 through 43. The last two items displayed the stimuli in the same form as the pretest.

Probe two

The second day's items of the pretest were given for probe two in the session following completion of the first b or d program. There was no verbal requirement and the 50% criterion was used. All groups received this probe in the same manner.

b or d program

Those subjects who had received the b program previously now received the d program and vice versa. The 90% criterion was in effect. The instructions remained the same as did the verbal label requirement for the required verbalization group.

Probe three

Day one of the pretest was given the session following completion of the second program. All groups had the 50% criterion and no required verbalization.

Combination program

This was the first time, on other than pretests, that b and d were both distributed across the session as samples. The program took two days and a 90% criterion was used each day.

The subjects who had finished the b program most recently received a d combination program. This procedure was used because the correct stimulus on the first 4 items was the one that had been most recently trained.

b and d combination programs

The positions of the correct stimuli and fading sequence were the same on both programs. Consequently, only the b combination program will be described below.

The b sample on the first four items was of primary type size. On items five through seven, the d sample began as 3/4 in. and faded by 1/8 in. so it measured ½ in. Another 1/16 in. was faded on item eight. The next three items had the b of primary type size as the sample. The d sample, on items 12 through 14 again faded by 1/16 in. The b was the sample on the next two items. On items 18 and 19, the d sample faded by 1/16 in. Items 19 through 21 had the b as sample. The next two items (22,23) had the d fade again by 1/16 in. with item 24 the same height as 23. Item 25 had the b as the sample while item 26 had the d at 5/16 in. The b was the sample on items 27 and 28. The sample 29 and 30 was a 1/4 in. d. Two more b samples followed with a d sample on item 33 at 1/4 in. Item 34 was a b with a d at primary type size on items 35 and 36. Item 37 was a b and 38 and 39 were d's. Items 40, 42, and 45 had b samples and 41, 43, 44 were d samples. Therefore, both b and d were used as samples to prepare the subjects for the posttest when again they would both be used as samples.

Recall of verbal label

The recall of verbal labels consisted of 10 4" x 3" cards. They were shown to the subjects one at a time immediately following the combination program. The instructions were the same on all cards and for both required verbalization and no-required verbalization groups. On each card the experimenter said, "Is this Bonghy-Bee or Duh?" There was a 50% criterion.

Posttest

Day two of the pretest was given to all subjects with a 50% criterion and no verbal requirement of any subject.

Reliability

An observer, viewing the experimental sessions through a one-way mirror took reliability every day on one subject from the refrain-required verbalization group and from the point-no-required verbalization group. The observer recorded the same data as did the experimenter, (i.e., position of stimulus subject pointed to and its correctness.) A different observer took reliability every other day on a subject from the sit-no-required verbalization group and randomly throughout the study on the rest of the population. Reliability was computed by dividing the number of agreements of correct subject response by the number of agreements plus disagreements.

RESULTS

Reliability

Observer one who took reliability on the refrain-required verbalization group and the point-no-required verbalization group obtained 99% reliability with the experimenter. The only source of consistent reliability disagreement occurred for observer one on one day of the story condition. This disagreement arose due to a confusion over which stimulus the experimenter's instructions and requests to respond to were related. Observer two who took reliability on the sit-required verbalization and the sit-no-required verbalization groups also obtained 99% reliability with the experimenter. No systematic reliability disagreements were noted (only isolated and scattered disagreements) with this latter observer.

Graphic results of our treatment groups

The results of the pre-post and test probes for all four treatment groups are graphed in Figure 1. The percent correct on the two days of the pretest (both pretest days were combined under "pre") indicated that all four groups were initially similar. Both the refrain-required verbalization (dashed line) and the sit-no-required verbalization (dashed-dot line) group had 53% correct; while the point-no-required verbalization (dotted line) and the sit-required verbalization (solid line) groups had 54% correct.

Insert Figure 1 About Here

Following the pretests, the story was read. The results of the story and the b and d programs are graphed in Figure 2. During the

Insert Figure 2 About Here

story program two groups were required to point to the appropriate character while either the experimenter read the refrain (point-no-required verbalization) or while the subject emitted the refrain (refrain required verbalization). The percent correct for these two groups for pointing to the correct character was 96% for the refrain-required verbalization group and 92% for the point-no-required verbalization group. No percentages are shown for the other two groups since they were only required to sit during the reading of the story and therefore no pointing response was emitted. Besides data on the pointing response, data was also taken on correctness of saying each refrain in the story for the refrain-required verbalization group. They all said the correct refrain 100% of the time for each character each time that character appeared in the story.

Percent correct on the probe after the story (indicated as the first "probe" in Figure 1) shows that the different group percentages stayed the same or slightly decreased after the pretest. The sit-required verbalization group had the highest percentage at 54% followed by the sit-no-required verbalization group with 52% correct. The refrain-required verbalization group had 50% and the point-no-required verbalization group had 48% correct.

On the first b or d program (indicated as "b or d" in Figure 2) both the refrain-required verbalization and the point-no-required verbalization group had 91% correct. The sit-required verbalization group had 90% while the sit-no-required verbalization group had 86% correct. These high percentages show near errorless responding in the programs for all groups.

The percent correct on the probe after the b or d program (indicated as the middle "probe" in Figure 1) shows a difference in groups. The refrain-required verbalization group had the highest percentage at 63% (an increase of thirteen percent age points). The point-no-required verbalization group had 53% while the remaining two groups (both of the sit groups) had 48% correct.

On the second b or d program (indicated as "d or b" in Figure 2) there is again indication of fairly successful responding with all groups having 90% correct or above. The refrain-required verbalization group had 96% while the point-no-required verbalization group had 93%. Both the sit-required verbalization and the sit-no-required verbalization group had 90% correct.

The probe after the second b or d program (indicated as the third "probe" in Figure 1) shows increasing percentages correct for all groups. The refrain-required verbalization group had 68% correct followed by 60% for the point-no-required group. Both the sit-required verbalization and the sit-no-required verbalization group had 56% correct.

The percentages correct on the combination program are shown in the lower portion of Figure 3. The two required program verbalization groups are on the left half of the graph with the two no-required program verbalization groups on the right. The words under the bars indicate the story requirement. On the combination program, the refrain-required verbalization group had 84% correct and the sit-required verbalization had 59%. The point-no-required verbalization group had 72% and the

----
Insert Figure 3 About Here
----

sit-no-required verbalization group had 58% correct. The more successful responding on the combination program appeared to be by those groups that pointed (or pointed and verbalized) on the first story program. Both groups that sat during that first program appeared to be operating just above chance on the combination program.

At the end of the second day of the combination program (day 16, Table II) another probe of the names of the b (Bonghy-Bee) and d (duh) was made. The top portion of Figure 3 shows the percent correct on recall of these verbal labels. The two required b-d program verbalization groups had the highest percentages. The refrain-required verbalization group had 80% correct, followed by the sit-required verbalization group with 53%. The point-no-required verbalization group had 46% and the sit-no-required verbalization group had 35% correct.

The percent correct on the posttests (indicated as "post" on Figure 1) show the largest differences between the four groups. The highest percentage is 89% correct for the refrain-required verbalization group. The point-no-required verbalization group and the sit-required verbalization group were similar with 69% and 68% correct responses respectively. The sit-no-required verbalization group was the lowest with 52% correct. This latter group, therefore, showed no change in performance since it had 53% correct on the initial pretest.

Just prior to the running of the b and d programs, each subject was asked the name of the character which was the sample stimulus on the initial item of the program. The experimenter pointing to the sample stimulus asked each child whether that was "Bonghy-Bee" or "Duh". If the child was correct he was socially reinforced; if incorrect he was told which character it was. This response was recorded for each child prior to their first and second (b or d) programs. These data can be considered to be probes of label recognition of the stimuli: configurations at the point when the story ended and the program began. The percent correct for each group on recalling the verbal labels prior to the first (b or d) and second (d or b) programs is shown in Table III.

Insert Table III About Here

Prior to the first program, the refrain-required verbalization group made 80% correct. Only one subject incorrectly labeled the sample stimulus. A different subject incorrectly labeled the sample stimulus prior to the second program resulting in 80% correct again scored for the second program. The point-no-required verbalization group had the same 80% correct prior to both programs. The sit-required verbalization group had 63% prior to the first program. This percentage increased prior to the second program to 100% correct recall of the correct sample stimulus. Prior to the first program, the sit-no-required verbalization group had 50%. None of the subjects was correct (0%) prior to the second program. The last two groups deviated completely on this probe prior to the second program, whereas they had been quite similar in their percent correct responding (63% and 50%) prior to the first program. The group that increased correct responding was required to verbalize on the intervening program, whereas the group that decreased to zero percent correct was not required to verbalize.

Analysis of variance (trend tests) of four treatment groups

Table IV is a summary table for the analysis of variance based on a

----
Insert Table IV About Here
----

trend analysis of the four groups (Edwards, 1953). The groups (4) x probes (6) interaction shows there was a significant interaction across the four groups for the six probe tests at less than the .05 level. Since a significant interaction was obtained then it would indicate that the different groups increased their percent correct across probe tests at different rates. This interaction was expected since the subjects were initially selected (on the basis of their pretest scores) to be very similar between the four groups. However, the different programming manipulations were designed to differentially effect the different groups across the probes. This would result in non-parallel trends and therefore an interaction effect.

The summary tables shown in Table V were then done on all possible two treatment group combinations after the interaction between the four groups was shown. The significances by group combinations of each of the two groups are shown in Figure 4. The graph on the top left (refrain-required verbalization and sit-no-required verbalization groups) shows a significant interaction (shaded section) between the two groups, as does the summary table (significance $< .05$) for these groups (shown on the top table of Table V). A significant interaction was also shown between the refrain-required verbalization and point-no-required verbalization groups (second table in Table V and middle right graph in Figure 4). Also the refrain-required verbalization and the sit-required verbalization groups (third table in Table V and lower right graph in Figure 4)

Insert Table V About Here

Insert Figure 4 About Here
----

comparison resulted in a significant interaction at <.05. These individual comparisons of the refrain-required verbalization group with each of the other three groups indicates that in all instances there was a significant interaction involved. This suggests that the refrain-required verbalization group was always significantly divergent (not parallel) across probes when compared to all other groups. Since this group always had the highest percentage of correct responses from the second probe onward, then it would appear that this group's rate of acquisition was faster than all other groups.

The graph on the top right in Figure 4 and the summary table at the top of the second page of Table V indicates that for these two groups there was a significant (<.05) probes effect. This would indicate that the groups increased their percentages of correct responding significantly somewhere during the probes. The bottom two graphs on the right side of Figure 4 show no significances for any effects between the point-no-required verbalization and the sit-no-required verbalization groups (middle table on page 2 of Table V) and between the sit-required verbalization and the sit-no-required verbalization groups (bottom table on page 2 of Table V).

Individual subject graphs

Subjects A, D, and I of the refrain-required verbalization group in Figure 5 showed the typical "learning curves" on their probe tests

Insert Figure 5 About Here

as they progressed through the study. All obtained posttest scores above 90% correct. Subject V increased across probes also but reached within the 80% to 90% range on the posttests. The only subject not demonstrating acquisition in this group was subject P. The programs did not seem to be effective in helping him acquire the discrimination.

The individual curves for subjects in the point-no-required verbalization group (Figure 6) indicated that three of the children (subjects Z, J, and F) did not acquire the discrimination while one (W) did. One subject (H) slightly improved on the posttest. These children never verbalized on either the story or the b or d programs and this complete lack of verbalization may have resulted in the program being successful for only one subject.

Insert Figure 6 About Here

The sit-required verbalization group showed slightly different individual curves (Figure 7). Although none of the individual children acquired the discrimination as in the refrain-required verbalization group, three (E, Y, and M) of the four increased slightly across probes, indicating some acquisition. This group did verbalize on the b and d programs and these individual graphs may suggest that the b and d program verbalization is slightly more effective when compared with the previous point-no-required verbalization group. Although the group graph of these two groups (Figure 1) does not indicate any difference between them, it may be that the different effects are in terms of the proportion of children in any one group that is mildly affected by the procedures.

Insert Figure 7 About Here

The group that showed the least number of individual graphs where acquisition could be concluded was the sit-no-required verbalization group (Figure 8). Subjects C, L, and B maintained the same percentage

----
Insert Figure 8 About Here
----

of correct responses across probes or slightly decreased. Subject S showed a slight increase; however, the posttest score was still around chance responding. These subjects had the least opportunity to respond to either the story program or the b and d program and their behavior seemed to reflect this.

DISCUSSION

The results of this study seem to clearly indicate that probably most preschool children could be taught the rather difficult discrimination of matching a 'b' with a 'b' when 'd' is one of the other matches or distractors (and vice versa). However, it is also clear that in order to teach this discrimination the child must: 1) actively engage in the procedures by pointing to pictures that initially are very different characters in a story; 2) learn a verbal label for these characters; 3) continue to apply the label as the characters are shaped into configurations that at first contain the b and d but barely resemble them and later become the letters through fading procedures; 4) that the verbal label should be acquired prior to the discrimination of the visual forms.

The use of three other variations on this "package" treatment group indicated that if any one of the above procedures was left out, that the proportion of the population that would probably acquire the discrimination would be appreciably reduced.

It also appears that most children, given the "package" of procedures investigated, could acquire the discrimination with very few errors. The visual stimuli involved in the b and d programing procedures appear to be arranged in such a manner that most children made fewer than 10% errors on either program regardless of which treatment group they were in. However, the visual program itself was not sufficient to teach the discrimination. The child's behavior during the story could also be almost errorless as he learns the name that goes with the characters. But the story itself was not sufficient to teach the discrimination.

The use of probe tests between the various programs allowed the effects of various procedures to be assessed as the child progressed through the experiment. For example, the effect of the story on the terminal discrimination appeared to be non-existant since the first probe after the pretest showed no change or even slight decreases by each group. However, the first check of the characters' names at the beginning of the program following the story indicated that the groups were different and that those who pointed to or pointed to and verbalized the name in the story program had remembered it fairly well. Those children whose behavior was sitting during the story showed some memory for the characters' names but only for about half of the subjects in those two groups. The use of probes on both the criterion behavior (the discrimination of the b and d) and on smaller segments of behavior (the verbal label of the different characters) allows a more confident interpretation of the variables responsible for the treatment differences. The use of these probes also points out that a test of only criterion behavior will not necessarily reveal partial acquisition of those responses thought to contribute in some way to the final criterion response.

The least successful procedure of the various programs presented was the combination program. In Werner's earlier program the addition of the combination program had been found to be helpful. It was an easier task to teach a child a b - d discrimination when all of the trials in the day's session had _only_ either b or d as the sample stimulus (even though the matches included the d or b distractor). Evidently, a consistent left (or right) orientation of the sample stimulus across trials allows a preschool child to be more successful in matching. The number of possible (potential) correct stimuli on any one trial is reduced by half when all the samples in a day's session are of the same kind. When the samples present both b's and d's somewhat randomly across trials (within a session) then there is the possibility that either the b or the d on any one trial will by the S+ stimulus. This appears to complicate the problem. The combination program was designed to take two successively presented programs and combine them into a "simultaneous" (across trials but within sessions) format. The group that was able to make the highest percent of correct responses on the combination program was the group with the most verbal label training during the story and the b- d programs.

The verbal labels (responses) that the child was taught to emit to the b and d stimuli were taught to act later as discriminative stimuli when the child was matching under the more difficult conditions of randomly presented b and d samples. The child on any one trial had to look at the sample, identify it, and then for a brief period of time "retain" in some manner the identity of the sample while looking for its match out of three possible matches. It is during this short period of time that the child could have emitted the verbal label (identified in the sample) so that this response produced a discriminative stimulus that resulted in identifying the correct match. When the child did not have a verbal response (or some other response) that could be later used as discriminative stimuli for the matching responses; or when the verbal response was not accurate (on occasion calling 'b', "Duh") then the performance could decline with mirror image errors again occurring.

The best evidence to support the premise that the verbal label acted as a discriminative stimulus when the child was matching at the end of the training program was the name probe carried out at the end of the second day of the combination program. The only group that had a consistently high recall of the label was the refrain-verbalization group since the other groups operated at chance when recalling the names, or less than chance (could not recall the name). This would imply that those latter groups were not emitting the names or were emitting them improperly on the posttest.

It was not possible to record the verbal labeling behavior during the posttest since the experimenter told (and when necessary reminded) each subject to not verbalize the name, but only to point. This control was used so that all four groups would be posttested under the same requirements. However, it would seem that subvocal responding may have occurred for at least the two required verbalization groups. In the case of the refrain-verbalization group the recall of the verbal label could have been more accurate as shown by the name probe, and therefore discrimination behavior between the b and d ended at a high level of correctness.

If this interpretation is correct, then it tends to support: 1) the use of a labeling response (during a program that teaches a visual discrimination) to serve as an added discriminative stimulus for a final visual discrimination; and 2) the necessity of a programmed pretraining procedure to teach the verbal label prior to the program where the visual discrimination is trained.

Table 1

Four treatment groups

S's behavior during b, d and combination programs →	REQUIRED VERBALIZATION		NO-REQUIRED VERBALIZATION	
S's behavior during story program →	Verbal Refrain and Point	No Response Specified During Story (sit)	(sit)	Point
Average Age	4-yrs 3-months	4-yrs 2-months	4-yrs 3-months	4-yrs 2-months
Male/Female	2/3 N=5	2/2 N=4	2/2 N=4	2/3 N=5
Average Pretest Scores	53%	54%	53%	54%

Table II

Sequence for treatment groups

REQUIRED VERBALIZATION		NO-REQUIRED VERBALIZATION	
Pretest: Day 1 Day 2 Same for all groups			
Story: Verbal Refrain Point Days 3-7	Story: No response specified-sit Days 3-7	Story: No response specified-sit Days 3-7	Story: Point Days 3-7
Probe: Day 8 Same for all groups			
Program: Verbal label 3S's b; 2S's d Days 9 and 10	Program: Verbal label 2S's b; 2S's d Days 9 and 10	Program: No verbal label 2S's b; 2S's d Days 9 and 10	Program: No verbal label 3S's d; 2S's b Days 9 and 10
Probe: Day 11 Same for all groups			
Program: Verbal label 3S's d; 2S's b Days 12 and 13	Program: Verbal label 2S's d; 2S's b Days 12 and 13	Program: No verbal label 2S's d; 2S's b Days 12 and 13	Program: No verbal label 3S's b; 2S's d Days 12 and 13
Probe: Day 14 Same for all groups			
Combination Program: Verbal label 3S's d; 2S's b Days 15 and 15	Combination Program: Verbal label 2S's d; 2S's b Days 15 and 16	Combination Program: No label 2S's d; 2S's b Days 15 and 16	Combination Program: No label 3S's b; 2S's d Days 15 and 16
Name Probe: Day 16 Same for all groups Given immediately following combination program			
Posttest: Day 17 Same for all groups			

Table III

Percent correct on recall of verbal label prior to first (b or d) and second (d or b) programs

Groups	Prior to first program	Prior to second program
Refrain-required verbalization	80%	80%
Point-no-required verbalization	80%	80%
Sit-required verbalization	63%	100%
Sit-no-required verbalization	50%	0%

Table IV

Summary table for the analysis of variance based on a trend analysis of four groups (four conditions of learning) x six probes (tests)

Analysis of variance for all four groups

Source	df	SS	MS	F
Groups (4)	3	22.30	7.43	1.57
Error (A)	14	66.15	4.73	
Probes (6)	5	87.20	17.44	23.57*
Groups (4) x Probes (6)	15	27.47	1.83	2.47*
Error (B)	70	51.80	.74	
Total	107	254.92		

*$<$.05

Table V

Summary table for the analysis of variance based on a trend analysis of two troups (two conditions of learning) x six probes (tests)

Analysis of variance for refrain-req. verb; sit-no verb.

Source	df	SS	MS	F
Groups (2)	1	21.68	21.68	3.18
Error (A)	7	47.67	6.81	
Probes (6)	5	40.59	8.12	15.32*
Groups (2) x Probes (6)	5	36.88	7.38	13.92*
Error (B)	35	18.68	.53	
Total	53	165.50		

Analysis of variance for refrain-req. verb; point-no verb.

Source	df	SS	MS	F
Groups (2)	1	4.26	4.26	.56
Error (A)	8	60.35	7.54	
Probes (6)	5	88.93	17.79	22.79*
Groups (2) x Probes (6)	5	10.54	2.11	2.71*
Error (B)	40	30.83	.77	
Total	59	194.93		

Analysis of variance for refrain-req. verb; sit-req. verb.

Source	df	SS	MS	F
Groups (2)	1	7.17	7.17	.99
Error (A)	7	50.55	7.22	
Probes (6)	5	69.02	13.80	43.13*
Groups (2) x Probes (6)	5	17.91	3.58	11.18*
Error (B)	35	11.05	.32	
Total	53	155.70		

* <.05

Table V Continued

Analysis of variance for point-no verb; sit-req. verb.

Source	df	SS	MS	F
Groups (2)	1	.53	.53	.03
Error (A)	7	18.48	2.64	
Probes (6)	5	33.55	6.84	6.84*
Groups (2) x Probes (6)	5	1.65	.33	.33
Error (B)	35	35.12	1.00	
Total	53	89.33		

Analysis of variance for point-no verb; sit-no verb.

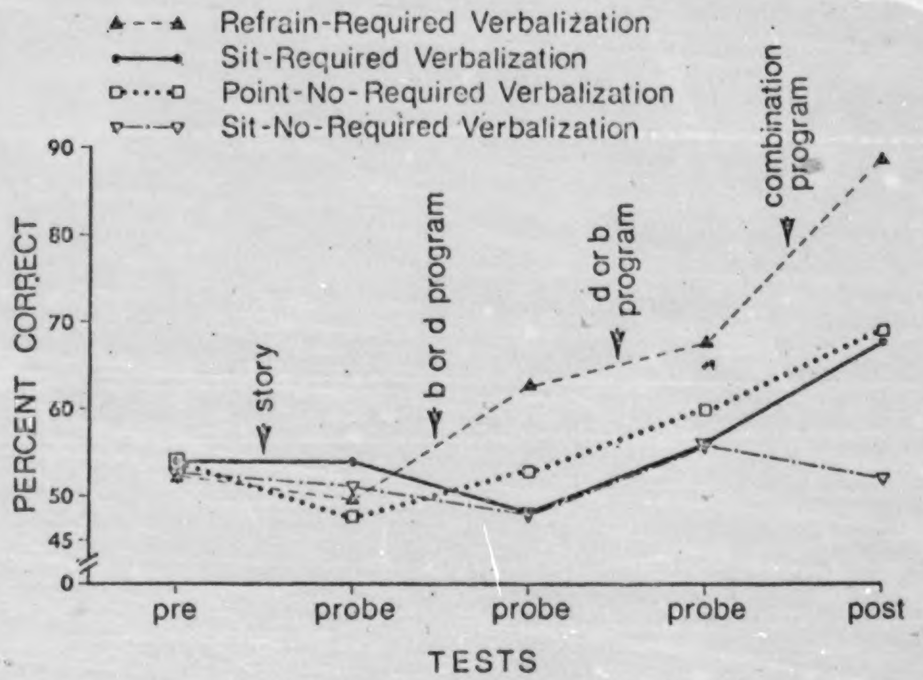
Source	df	SS	MS	F
Groups (2)	1	7.34	7.34	3.29
Error (A)	7	15.60	2.23	
Probes (6)	5	13.87	2.77	2.39
Groups (2) x Probes (6)	5	13.87	2.77	2.39
Error (B)	35	40.75	1.16	
Total	53	91.43		

Analysis of variance for sit-req. verb; sit-no verb.

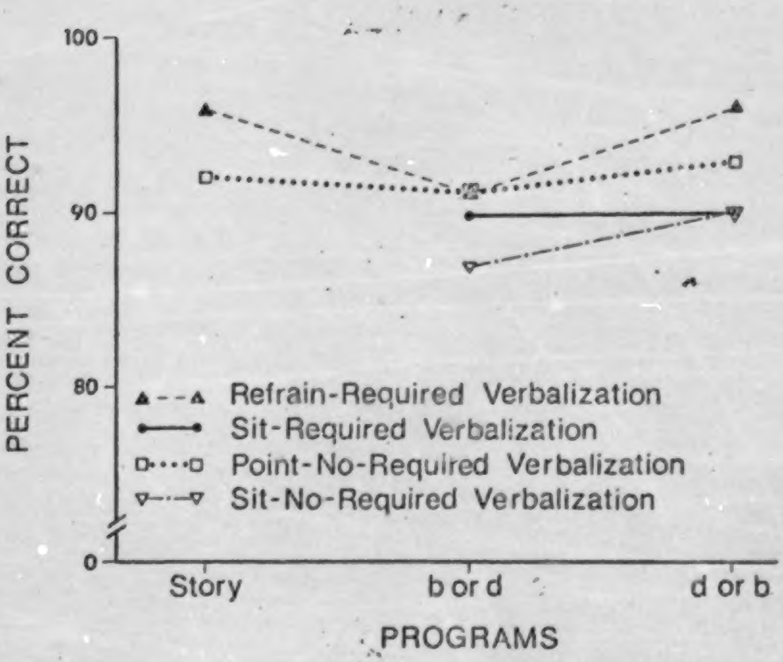
Source	df	SS	MS	F
Groups (2)	1	3.53	3.53	3.63
Error (A)	6	5.80	.97	
Probes (6)	5	6.87	1.37	.33
Groups (2) x Probes (6)	5	8.33	1.67	.40
Error (B)	30	20.95	.70	
Total	47	45.48		

*$<$.05

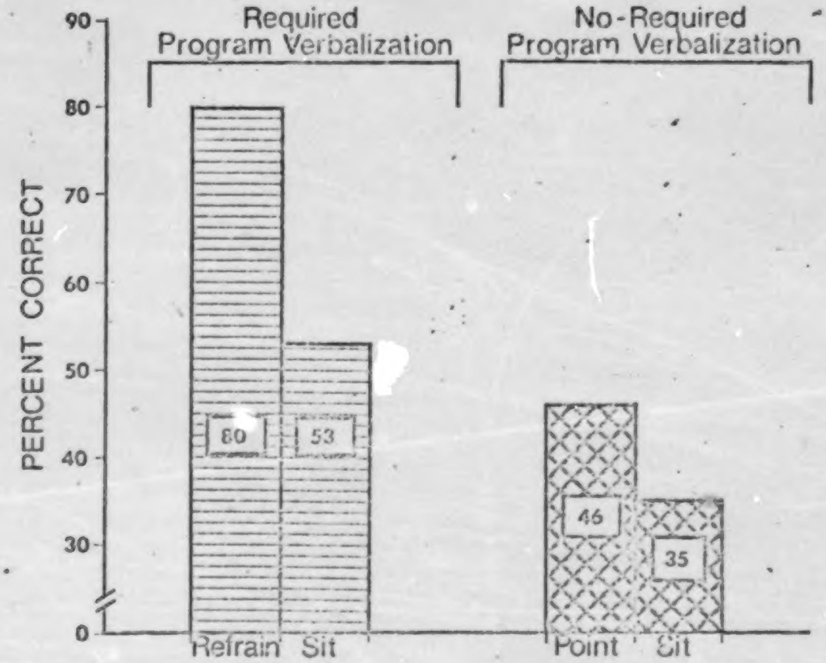
PERCENT CORRECT ON ALL TESTS



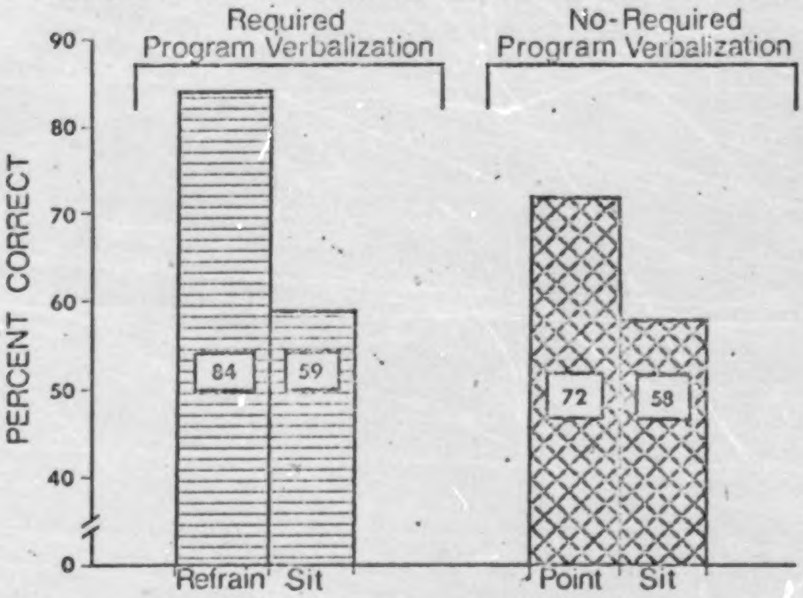
PERCENT CORRECT
ON ALL PROGRAMS



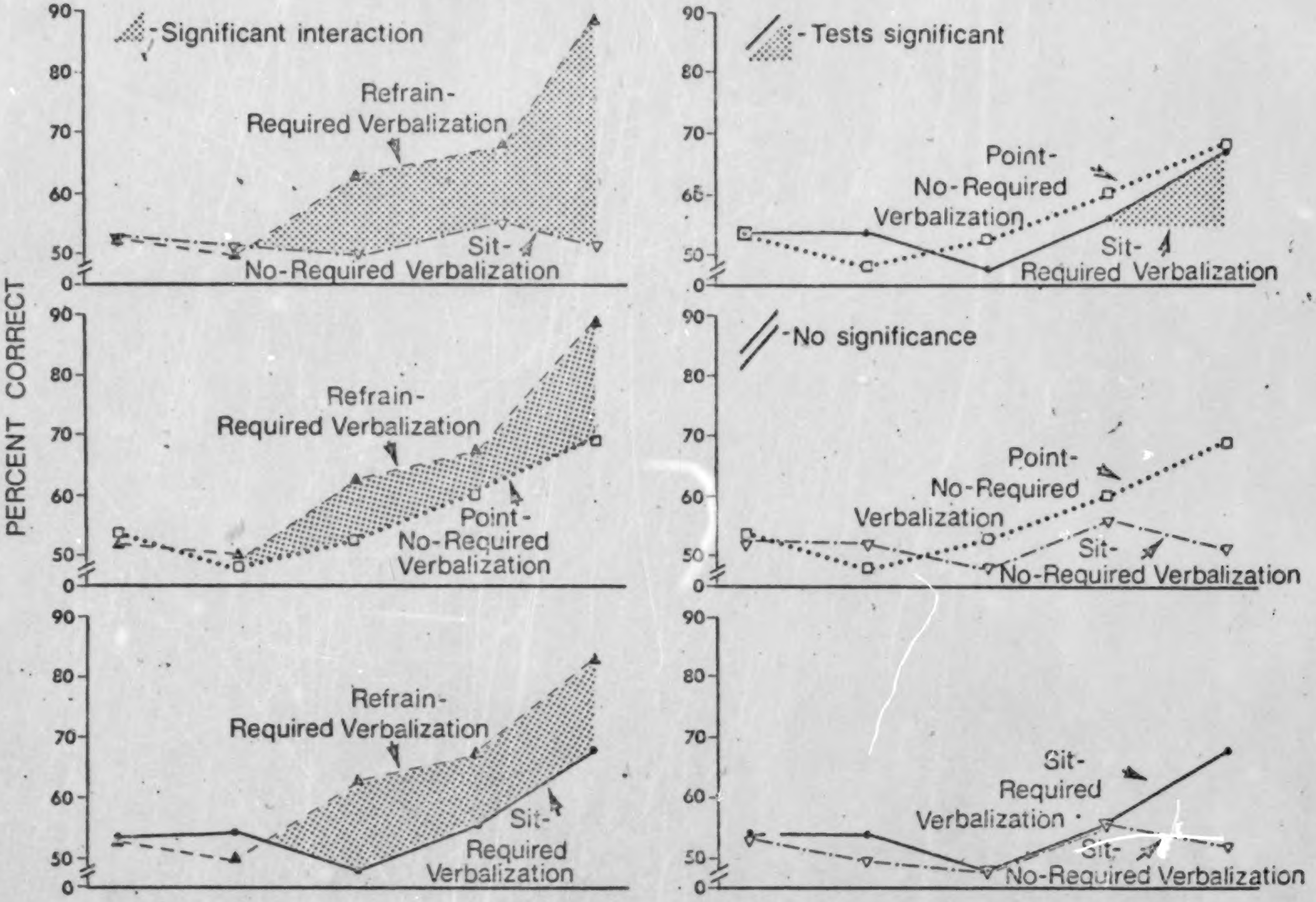
PERCENT CORRECT ON RECALL OF VERBAL LABEL



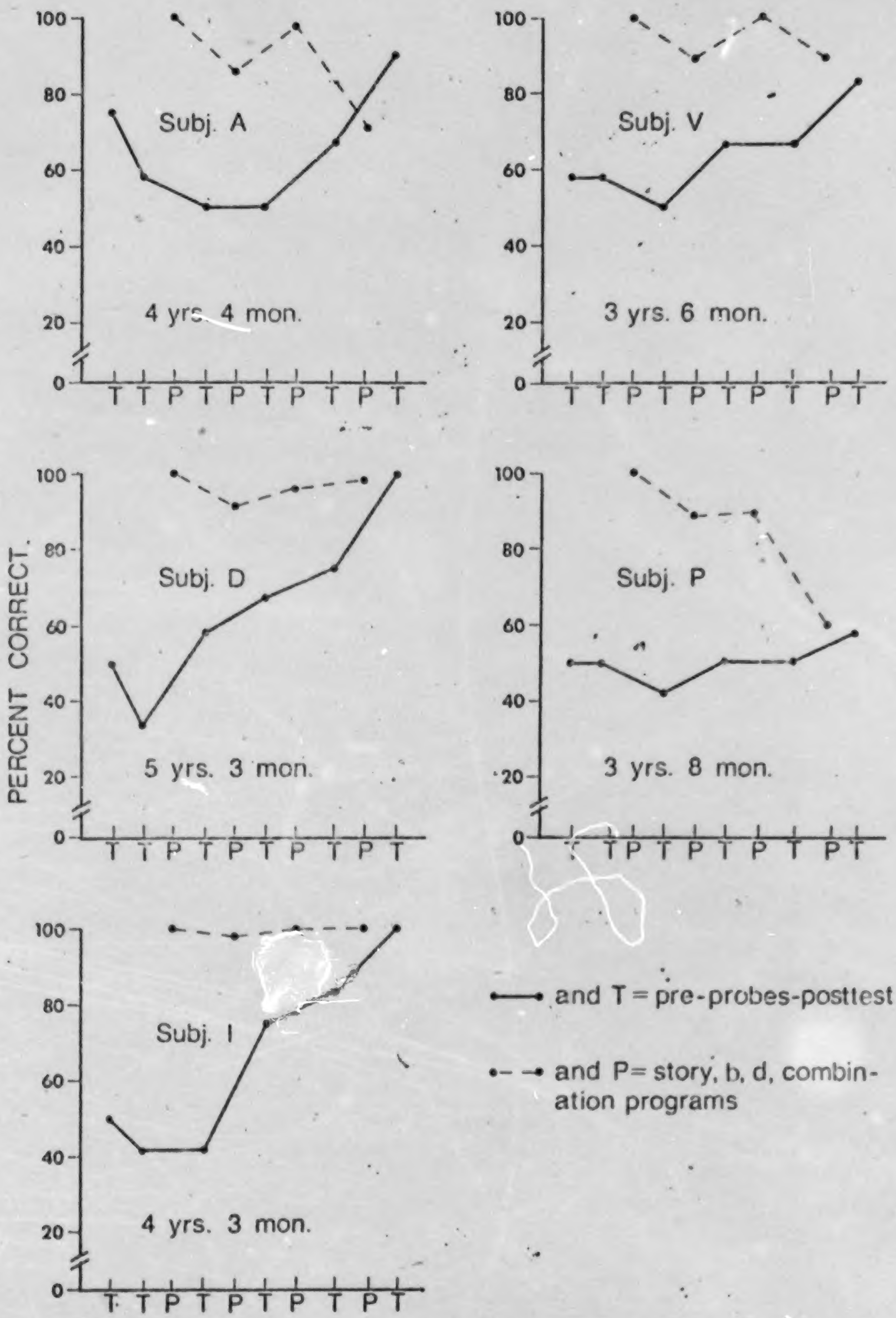
PERCENT CORRECT ON COMBINATION PROGRAM



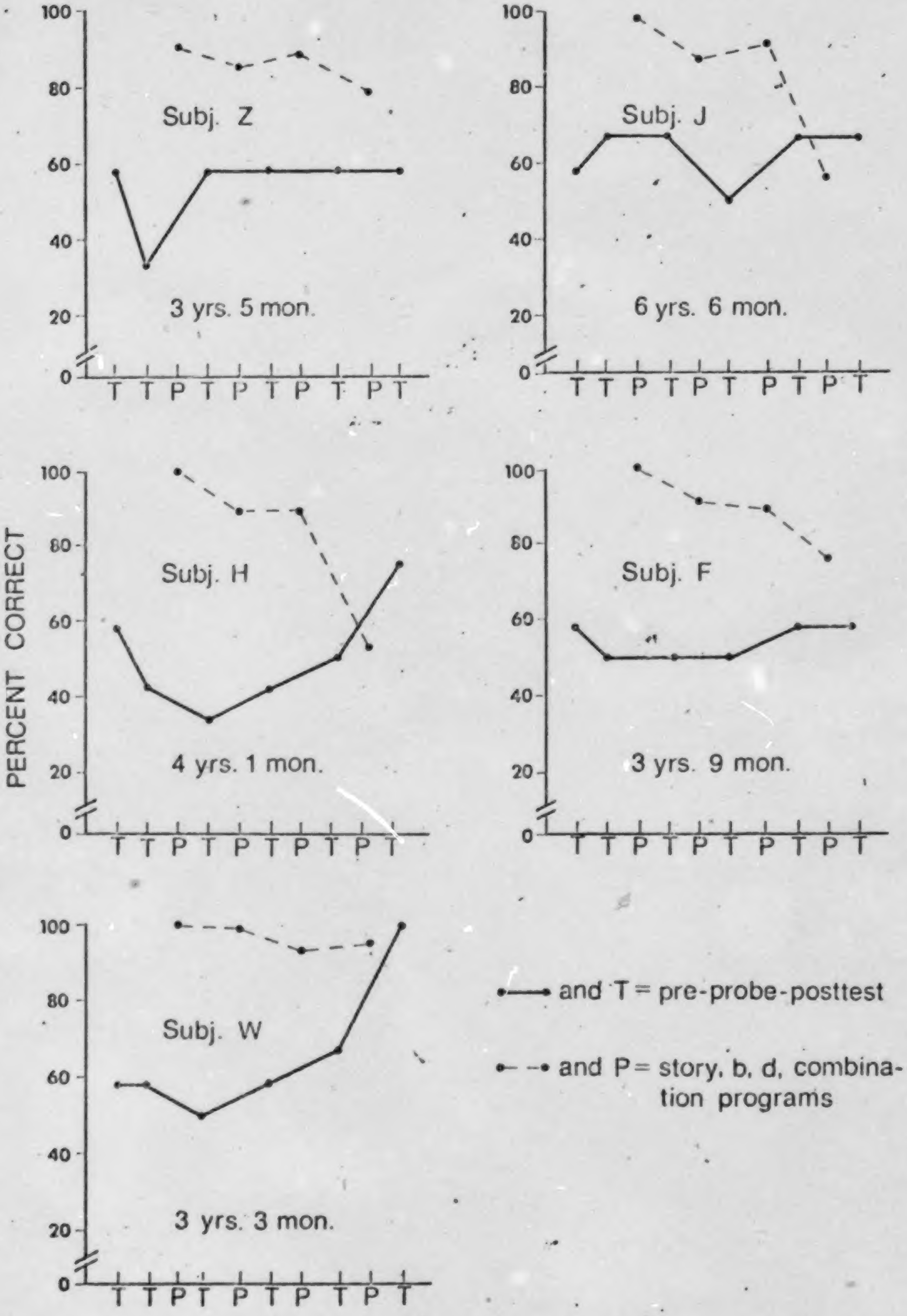
SIGNIFICANCES BY GROUP COMBINATIONS



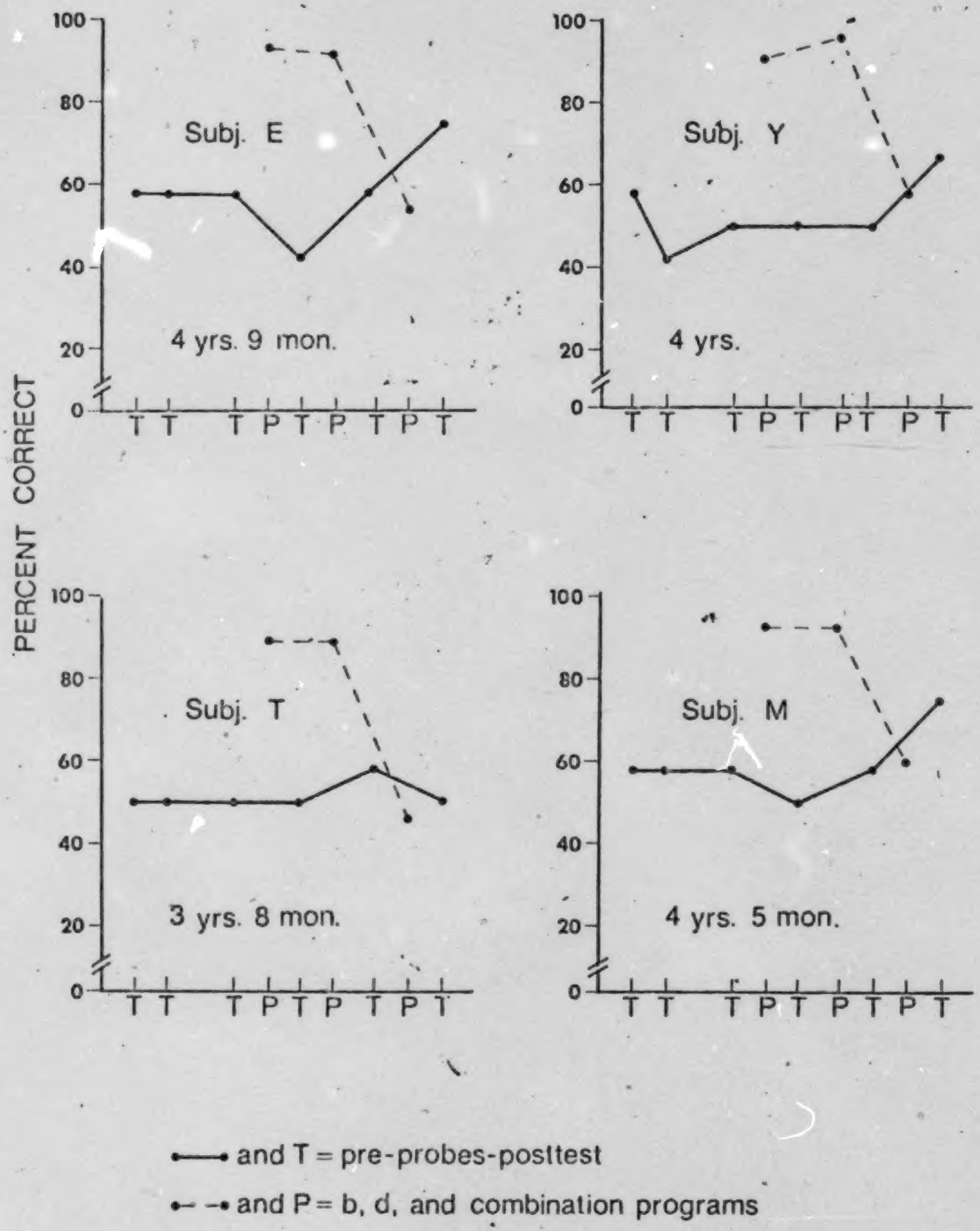
REFRAIN-REQUIRED VERBALIZATION GROUP



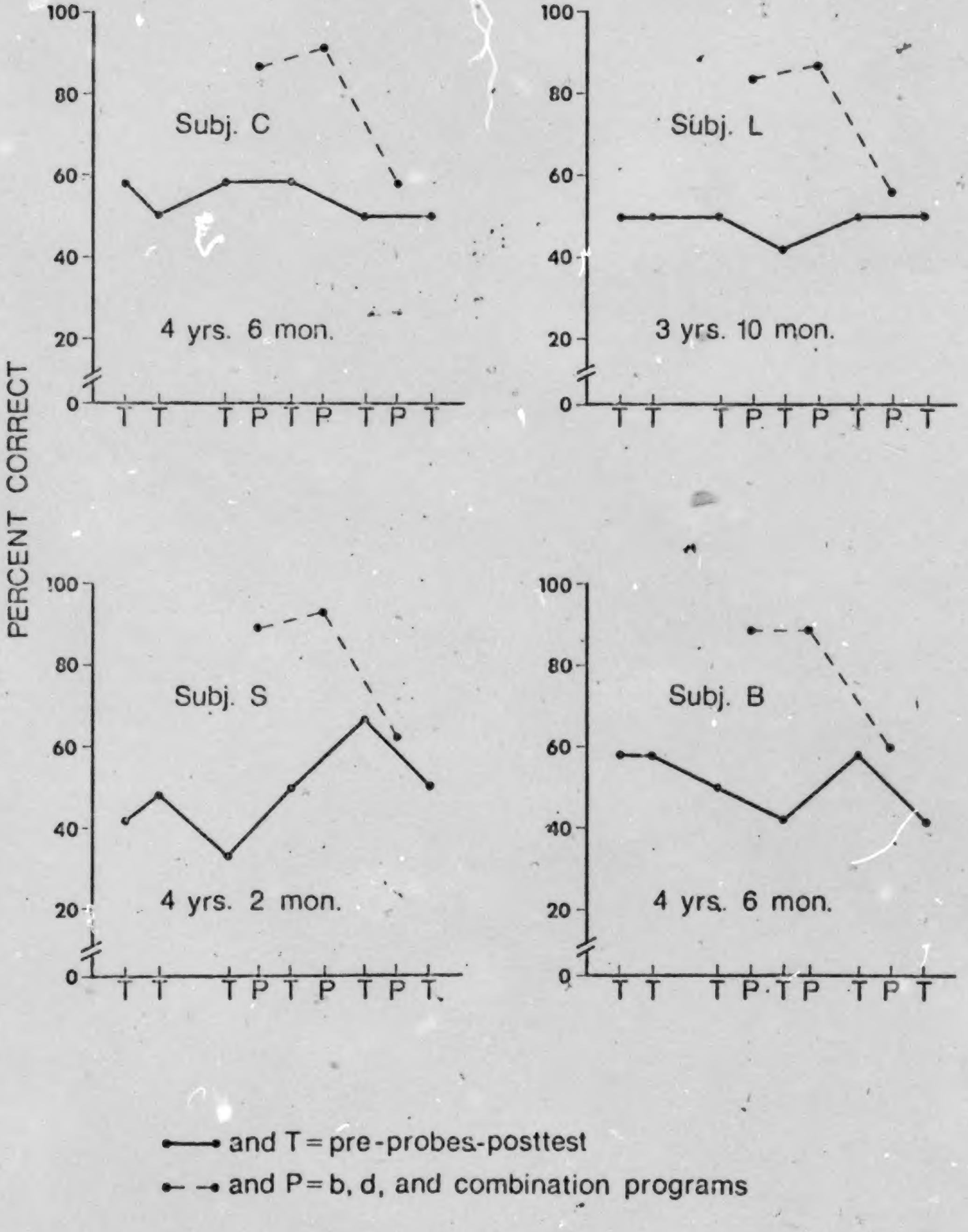
POINT-NO-REQUIRED VERBALIZATION GROUP



SIT-REQUIRED VERBALIZATION GROUP



SIT-NO-REQUIRED VERBALIZATION GROUP



PRETEST b-d

b	p	b	d
d	d	l	b
d	b	e	d
b	b	d	c
d	p	d	b
b	b	q	d

PRETEST b-d CONT.

d	l	b	d
d	b	d	c
b	d	p	b
b	e	b	d
d	d	q	b
b	l	d	b

BONGHY-BEE AND DUH STORY

1. This is Mother Duh. (Experimenter points to Mother Duh). Point to Mother Duh. Baby Duh is in her pouch. (Experimenter points to Baby Duh). Point to Baby Duh. Baby Duh likes to ride in his mother's pouch, and holds on tightly. "Uh huh," says Mother Duh when they are both having fun.

2. Mother Duh hops and hops. She hops over a puddle and a wagon. Point to Mother Duh. Baby Duh likes that very much. They are both having fun, so, "Uh huh," says Mother Duh.

3. Sometimes Mother Duh even jumps over things like trees and houses. Point to Mother Duh. Baby Duh goes sailing along with her. They both think this is great fun, so, "Uh huh," says Mother Duh.

4. Mother Duh and Baby Duh have many friends. One Friend they like to visit is Bonghy-Bee. (Experimenter points to Bonghy-Bee). Point to Bonghy-Bee. Bonghy-Bee has a magic bong stick that Baby Duh likes. (Experimenter points to the bong stick). Point to the magic bong stick. It makes things go away and come back again. When the bong stick works, Bonghy-Bee gets excited and, "Wee, gee," says Bonghy-Bee.

5. Bonghy-Bee enjoys going to the park with Mother Duh and Baby Duh on warm days. Point to Mother Duh. Point to Bonghy-Bee. On their way to the park, Baby Duh likes to play games. Mother Duh likes the games, too, so, "Uh huh," says Mother Duh. (2 pages)

6. When they get to the park, Bonghy-Bee shows how he can make things go away with his bong stick. Point to Bonghy-Bee. Point to Mother Duh. Quick as a wink the bush they had been standing by was gone. Bonghy-Bee got all excited and, "Wee, gee," says Bonghy-Bee. (2 pages)

7. (Right picture) Baby Duh thought Bonghy-Bee's magic stick was great when Mother Duh's hat was gone. POOF! Point to Mother Duh. Mother Duh wondered where her hat was and said the game was fun, so, "Uh huh," says Mother Duh.

8. (Left picture) Baby Duh wanted to know what other magic things Bonghy-Bee could do and Poof! Bonghy-Bee's stomach was gone. Point to Bonghy-Bee. His round tummy was gone as gone can be. Bonghy-Bee liked that and, "Wee, gee," says Bonghy-Bee.

9. Baby Duh was so happy that he began jumping up and down in his mother's pouch. When he stopped jumping, he found that his mother's ears were gone! Point to Mother Duh. Baby Duh and Mother Duh thought the game was great, so, "Uh huh," says Mother Duh.

10. Bonghy-Bee thought it was a good game making things go away. Point to Bonghy-Bee. Suddenly his own hands were gone! This was great, and "Wee, gee," says Bonghy-Bee. (End of session one)

a. Remember Bonghy-Bee and the magic bong stick? Point to Bonghy-Bee. Now point to Mother Duh. Do you remember the game they were playing?

11. (Right picture) Baby Duh wanted Mother Duh's nose to be gone. Just as soon as he had asked Bonghy-Bee, Mother Duh's nose was gone. Point to Mother Duh. At first, Mother Duh was surprised at what the magic bong stick had done, but then said it was fun, so, "Uh huh," says Mother Duh.

12. (Left picture) Then Bonghy-Bee said he would make one of his own legs leave with the magic bong stick and he did. Point to Bonghy-Bee. It was gone before he knew it and, "Wee, gee," says Bonghy-Bee.

13. Baby Duh said that he would like it very much if Mother Duh didn't have any eyes. Bonghy-Bee thought a minute, then POOF! Mother Duh's eyes were gone. Point to Mother Duh. Mother Duh thought the game was a good one, so, "Uh huh," says Mother Duh.

14. Before Baby Duh could say anything, the magic bong stick started working and Bonghy-Bee's other leg was gone. Point to Bonghy-Bee. This was exciting for Bonghy-Bee, and, "Wee, gee," says Bonghy-Bee.

15. Baby Duh was having the time of his life. He had Bonghy-Bee use his magic bong stick to make the rest of Mother Duh's head go away. Point to Mother Duh. Mother Duh looked very different without a head but she was enjoying the game, so "Uh nuh," says Mother Duh.

16. One of Bonghy-Bee's arms was there one minute and was gone the next. Point to Bonghy-Bee. The bong stick worked its magic very fast. Bonghy-Bee was excited, and, "Wee, gee," says Bonghy-Bee.

17. (Right picture) Baby Duh wanted one of Mother Duh's arms and hand to go away, too, and they did with the help of the bong stick. Point to Mother Duh. What a surprise to Mother Duh but the game was fun, so, "Uh huh," says Mother Duh.

18. (Left picture) The bong stick started working again before Baby Duh could say anything. Mother Duh's purse was the next thing to leave. Point to Mother Duh. Mother Duh thought it was great, so, "Uh huh," says Mother Duh.

19. Baby Duh wanted to know if Bonghy-Bee could use his magic bong stick to make his own feet leave and POOF! Bonghy-Bee had no feet but the flowers on the toes stayed on the ground. Point to Bonghy-Bee. Bonghy-Bee was excited to see that happen, and, "Wee, gee," says Bonghy-Bee.

20. Even though it was great fun to hop, Baby Duh was having such a good time watching things go away that he didn't want Mother Duh to hop anymore. All of a sudden, Mother Duh's long tail she used to hop with was gone. Point to Mother Duh. WOW! This game is fun! Both Mother Duh and Baby Duh agree, so, "Uh huh," says Mother Duh. (End of session two)

b. Do you remember Mother Duh and Baby Duh? Point to Mother Duh and Baby Duh. Do you remember Bonghy-Bee and the magic bong stick? Point to Bonghy-Bee. Do remember the game they were playing? Let's see what happens today.

21. (Right picture) What would go next? Baby Duh thought a minute and said his mother's other arm and hand. The magic bong stick went POOF! and they were gone. Point to Mother Duh. This was great, so, "Uh huh," says Mother Duh.

22. (Left picture) Now Baby Duh decided he wanted Bonghy-Bee's collar to go away. The magic bong stick made the collar go away like magic! Point to Bonghy-Bee. The game was so exciting for Bonghy-Bee, and, "Wee, gee," says Bonghy-Bee.

23. (Left picture) The next thing Mother Duh lost was her chest. Point to Mother Duh. The bong stick has made many things go away. Baby Duh and Mother Duh think the game is fun, so, "Uh huh," says Mother Duh.

24. (Right picture) Mother Duh couldn't walk without any feet but Baby Duh wanted them to be gone, and they were with the help of the magic bong stick. Point to Mother Duh. It was a different feeling not having any feet but it was fun, so, "Uh huh," says Mother Duh.

25. Next, Bonghy-Bee lost his other arm with the magic of the bong stick. Point to Bonghy-Bee. It would be hard to use his bong stick without his arm but Bonghy-Bee was excited, and, "Wee, gee," says Bonghy-Bee.

26. Baby Duh decided Mother Duh's legs should be gone. The magic bong stick started working again and made them leave. Point to Mother Duh. This game is great think both Mother Duh and Baby Duh, so, "Uh huh," says Mother Duh.

27. The magic bong stick was still at work and made Bonghy-Bee's hat leave. POOF! It was gone! Point to Bonghy-Bee. Bonghy-Bee was excited about that, and, "Wee, gee," says Bonghy-Bee.

28. Baby Duh thought it would be fun if his own ears were gone and in no time at all, they were with the help of the magic bong stick. Point to Baby Duh. WOW! Baby Duh said he really liked this game, so, "Uh huh," says Mother Duh.

29. The next things to go were Bonghy-Bee's eyes and nose. Bonghy-Bee liked the magic of the bong stick. Point to Bonghy-Bee. This was exciting for Bonghy-Bee, and, "Wee, gee," says Bonghy-Bee.

30. POOF! went the bong stick and Baby Duh's hands were gone. Point to Baby Duh. At first Baby Duh was surprised but both Mother Duh and Baby Duh said the game is fun, so, "Uh huh," says Mother Duh. (End of session three)

c. Do you remember Bonghy-Bee and the magic bong stick? Point to Bonghy-Bee. Do you remember Mother Duh and Baby Duh? Point to Mother Duh and Baby Duh. Let's see what they do today.

31. Quick as one, two, three, the pointed ears on Bonghy-Bee were gone. Point to Bonghy-Bee. The game with the magic bong stick was still exciting for Bonghy-Bee, and, "Wee, gee," says Bonghy-Bee.

32. The eyes and mouth on Baby Duh once were there but now they are gone. The bong stick made them leave, quick as a wink. Point to Baby Duh. What fun this magic game is, so, "Uh huh," says Mother Duh.

33. The bong stick worked next on Bonghy-Bee's hair and mouth. Suddenly they were gone! Point to Bonghy-Bee. When Bonghy-Bee noticed they were gone, he became excited, and, "Wee, gee," says Bonghy-Bee.

34. The next to go with the help of the magic bong stick was Baby Duh. Point to Mother Duh. He was gone as gone can be. Oh, what fun this game is, so, "Uh huh," says Mother Duh.

35. (Right picture) And Bonghy-Bee, why his whole head is gone now. Point to Bonghy-Bee. The game is really exciting for Bonghy-Bee, and, "Wee, gee," says Bonghy-Bee.

36. (Left picture) With Baby Duh gone, there was no need for Mother Duh's pouch so the bong stick made it go away, too. Point to Mother Duh. Both Baby Duh and Mother Duh agreed that the game is fun, so, "Uh huh," says Mother Duh.

37. Bonghy-Bee decided to play another game. He made the bong stick work more magic and made Mother Duh and Baby Duh come back to how they were before. Point to Mother Duh and Baby Duh. This was really a surprise to them, so, "Uh huh," says Mother Duh.

38. Bonghy-Bee decided to come back with his friends and quick as a wink, there he was. Point to Bonghy-Bee. Bonghy-Bee thought the bong stick could do some very exciting things, and, "Wee, gee," says Bonghy-Bee.

39. (Right picture) Next Mother Duh and Baby Duh were changed again with the help of the bong stick. Point to Mother Duh. This game is great fun, so, "Uh huh," says Mother Duh.

40. (Left picture) Bonghy-Bee now made himself leave, too. Point to Bonghy-Bee. He was excited because of all the things the bong stick could do, and the game was such fun, and, "Wee, gee," says Bonghy-Bee. (End of session four)

d. Do you remember Mother Duh and Baby Duh? Point to Mother Duh. Do you remember Bonghy-Bee and the magic bong stick? Point to Bonghy-Bee. Let's see what they are going to do today?

41. Bonghy-Bee, Mother Duh and Baby Duh wanted the magic bong stick to do different magic things today. Bonghy-Bee said he would use the bong stick to make them all get smaller and POOF! They were all a little bit smaller. Point to (cue Duh) and say Duh. Point to (cue Bonghy-Bee) and say Bonghy-Bee.

42. Baby Duh said he liked being smaller but he really wanted to be even smaller so that when he played hide and seek, no one would be able to find him. Point to (cue Duh) and say Duh. Point to (cue Bonghy-Bee) and say Bonghy-Bee.

43. Bonghy-Bee thought that being even smaller would be fun, so the magic bong stick went POOF again and made them all smaller again. Point to (cue Bonghy-Bee) and say __________. Point to (cue Duh) and say __________.

44. Mother Duh said she liked being small. She said she had not been small for a long time. When you are small, you can hide behind chairs, and bushes and all kinds of things. Point to (cue Duh) and say __________. Point to (cue Bonghy-Bee) and say __________.

45. Bonghy-Bee said that if he was very small, he would have his bong stick do magic and he would be so small that no one would know he was the one doing the magic. Point to (cue Bonghy-Bee) and say __________. Point to and say (cue Duh) __________.

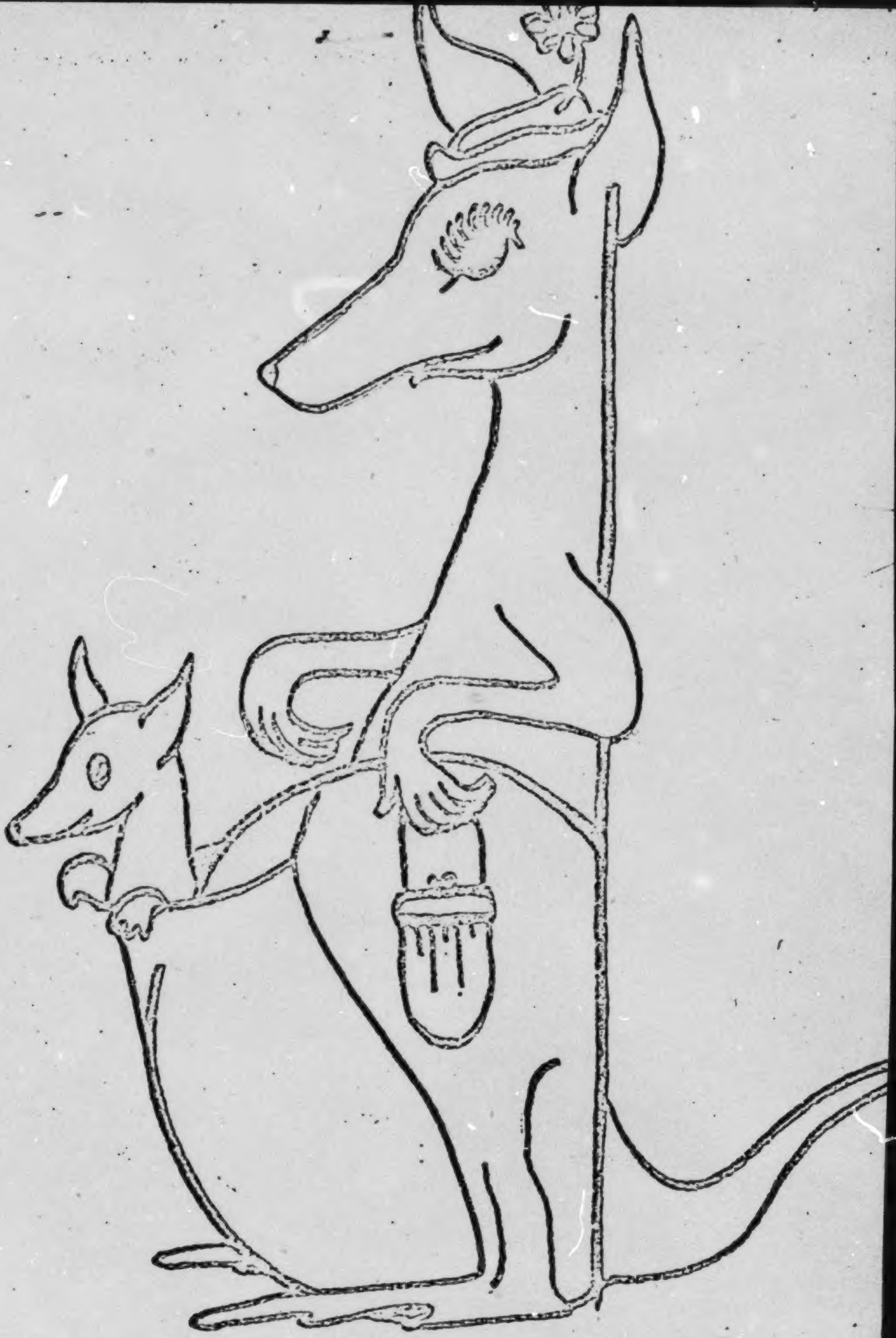
46. Baby Duh was small before they started to play the game so he knew he could do many things being small. Just think of all the things they could do if the bong stick made them all even smaller! Point to and say (cue Duh) __________. Point to and say (cue Bonghy-Bee) __________.

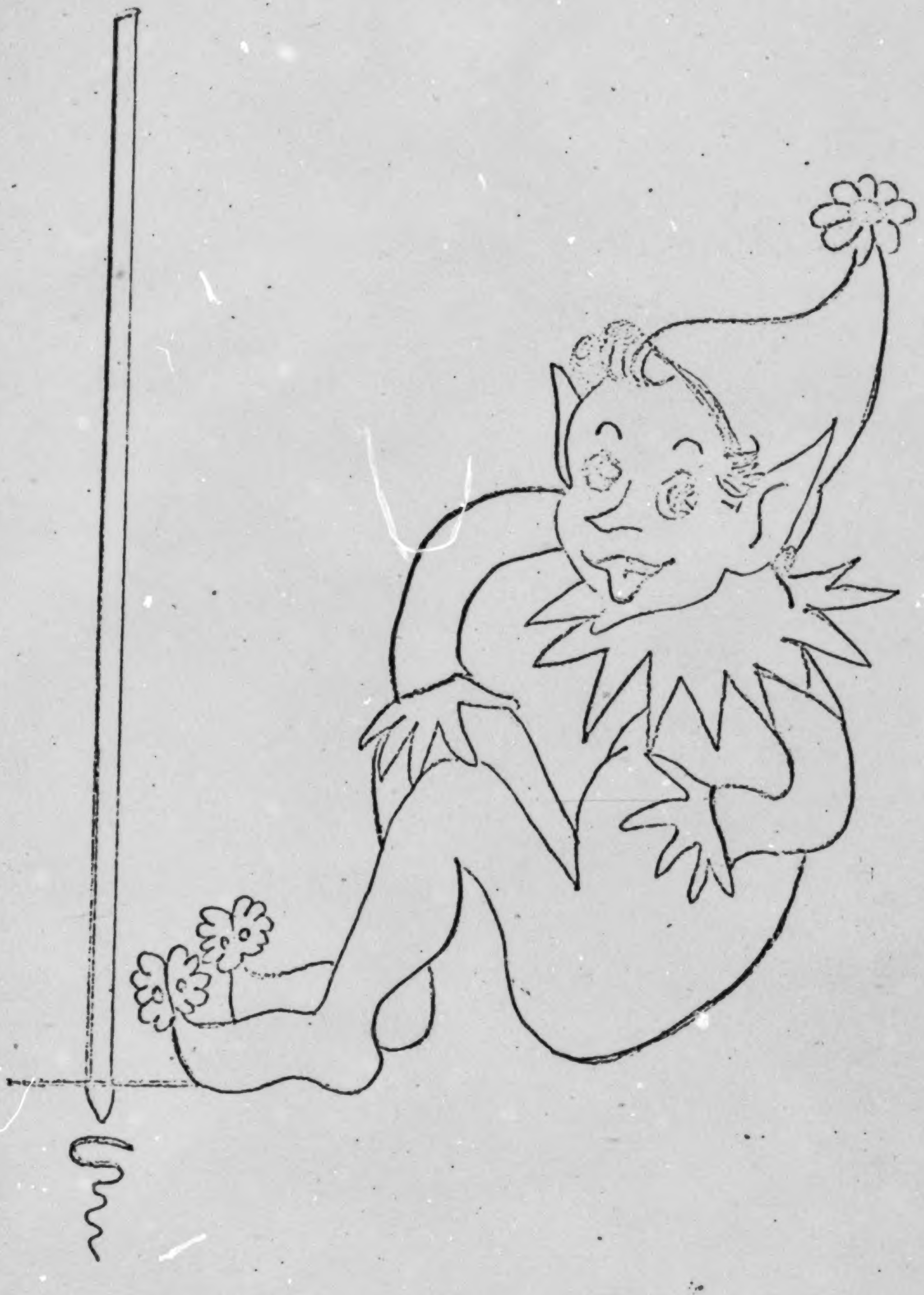
47. Baby Duh said he liked being smaller because he could hide behind grass and flowers. Bonghy-Bee said that sounded like fun so he had the magic bong stick make them all smaller. Point to and say (cue Duh) __________. Point to and say (cue Bonghy-Bee) __________.

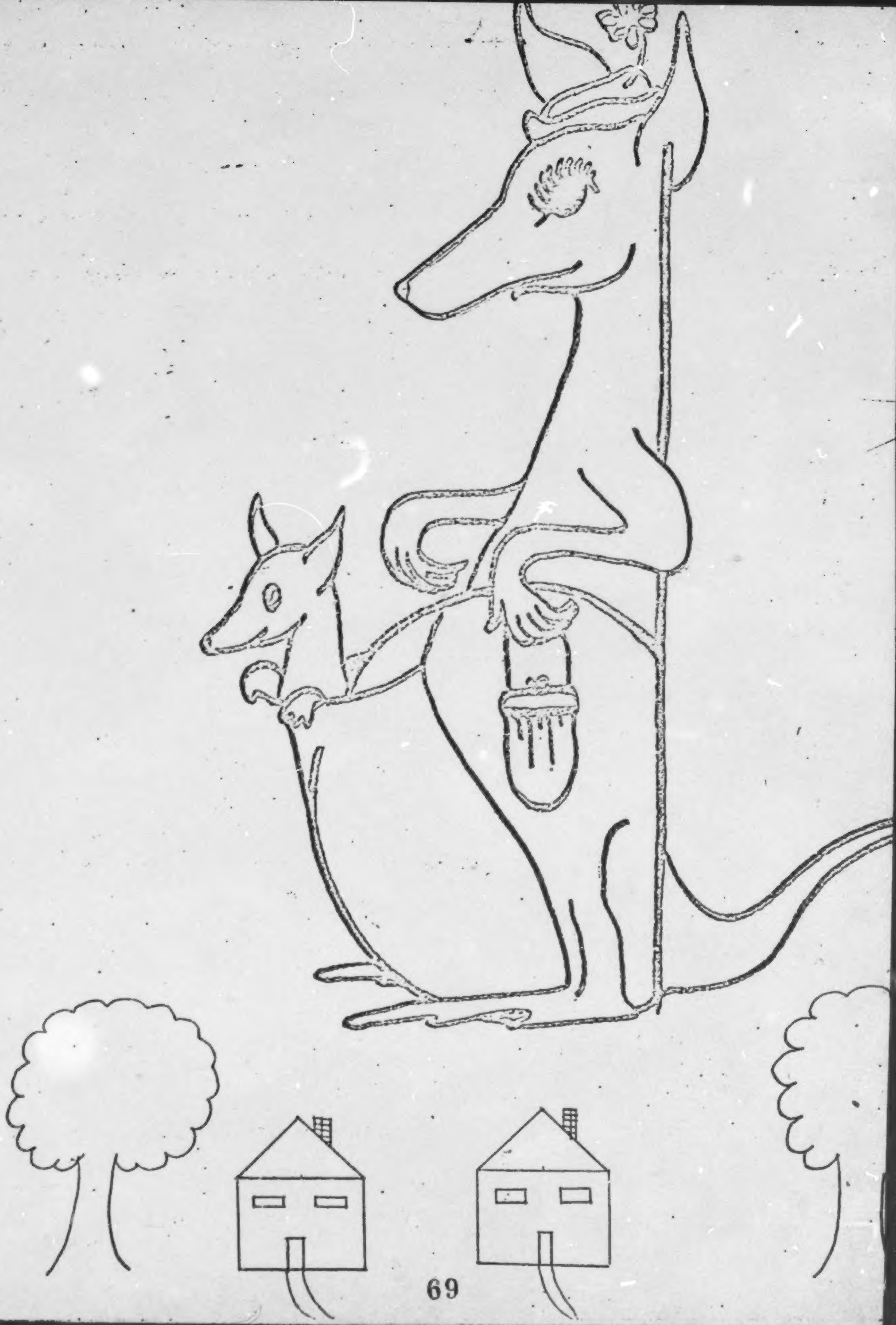
48. They all decided they wanted to be a little bit smaller because small is a nice thing to be. They knew they could always have the magic bong stick make them big again if they wanted. Point to and say (cue Bonghy-Bee) __________. Point to and say (cue Duh) __________

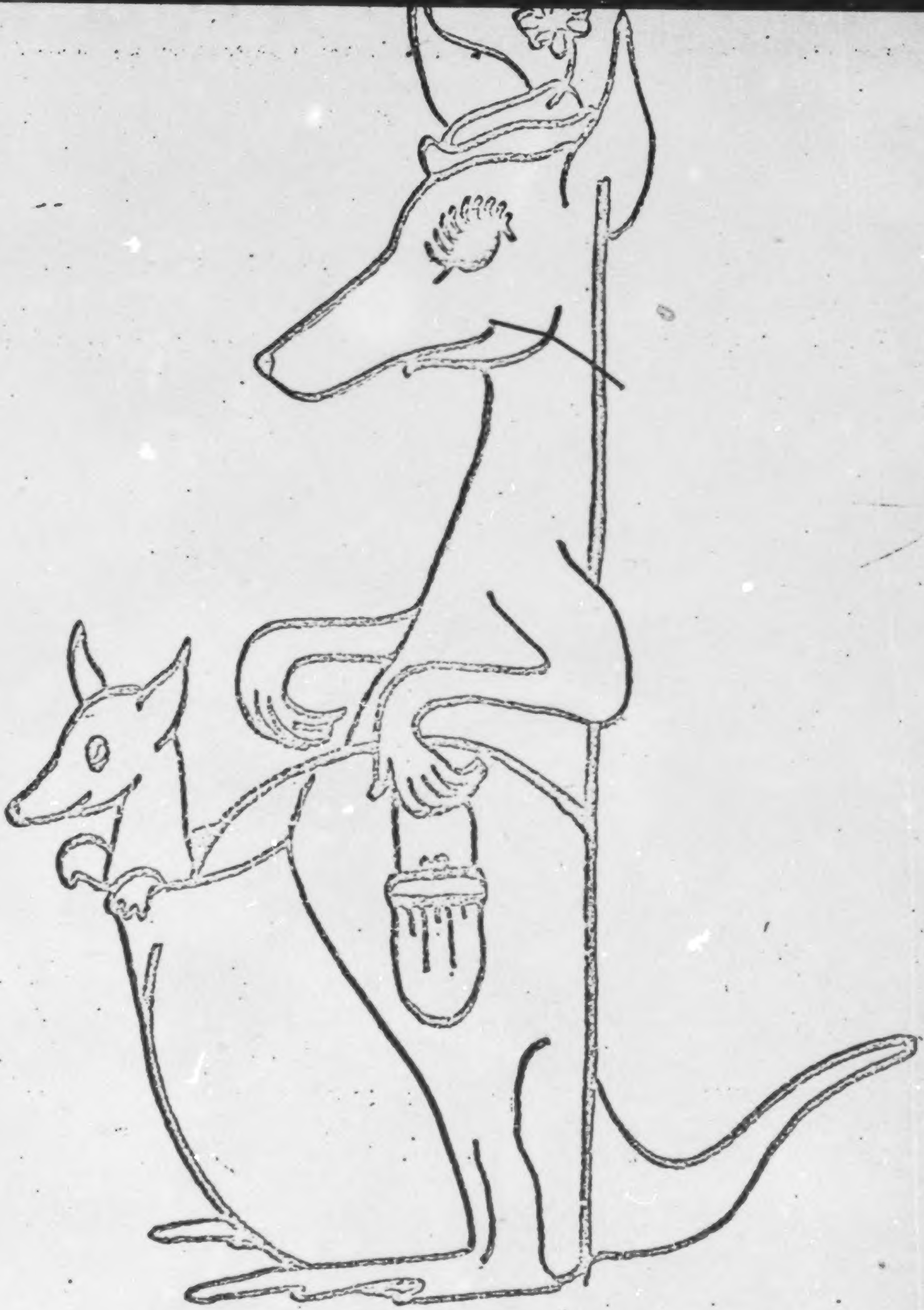
49. Bonghy-Bee was having a great time making them all small with the magic bong stick. He said he liked being small so much that he would make them small again. Point to and say (cue Bonghy-Bee) __________. Point to and say (cue Duh) __________.

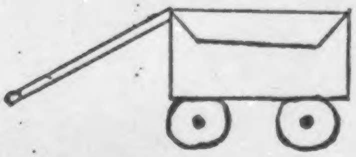
50. They decided they did want to be big again because they were tired and it was getting late. They knew they could play the game again some other day so the bong stick made them big again and home they went. Point to and say (cue Bonghy-Bee) __________. Point to and say (cue Duh) __________.
(End of session five)

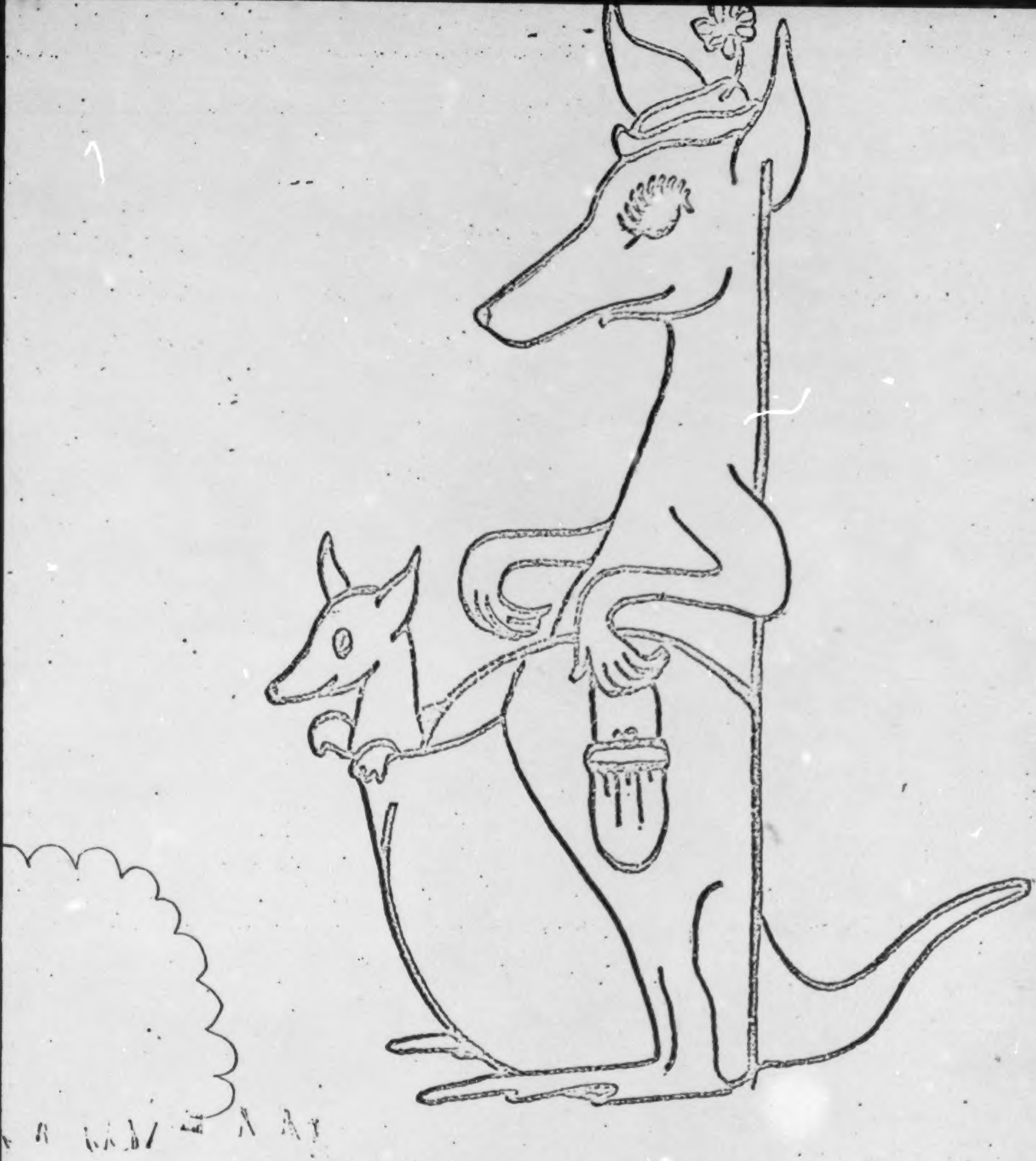


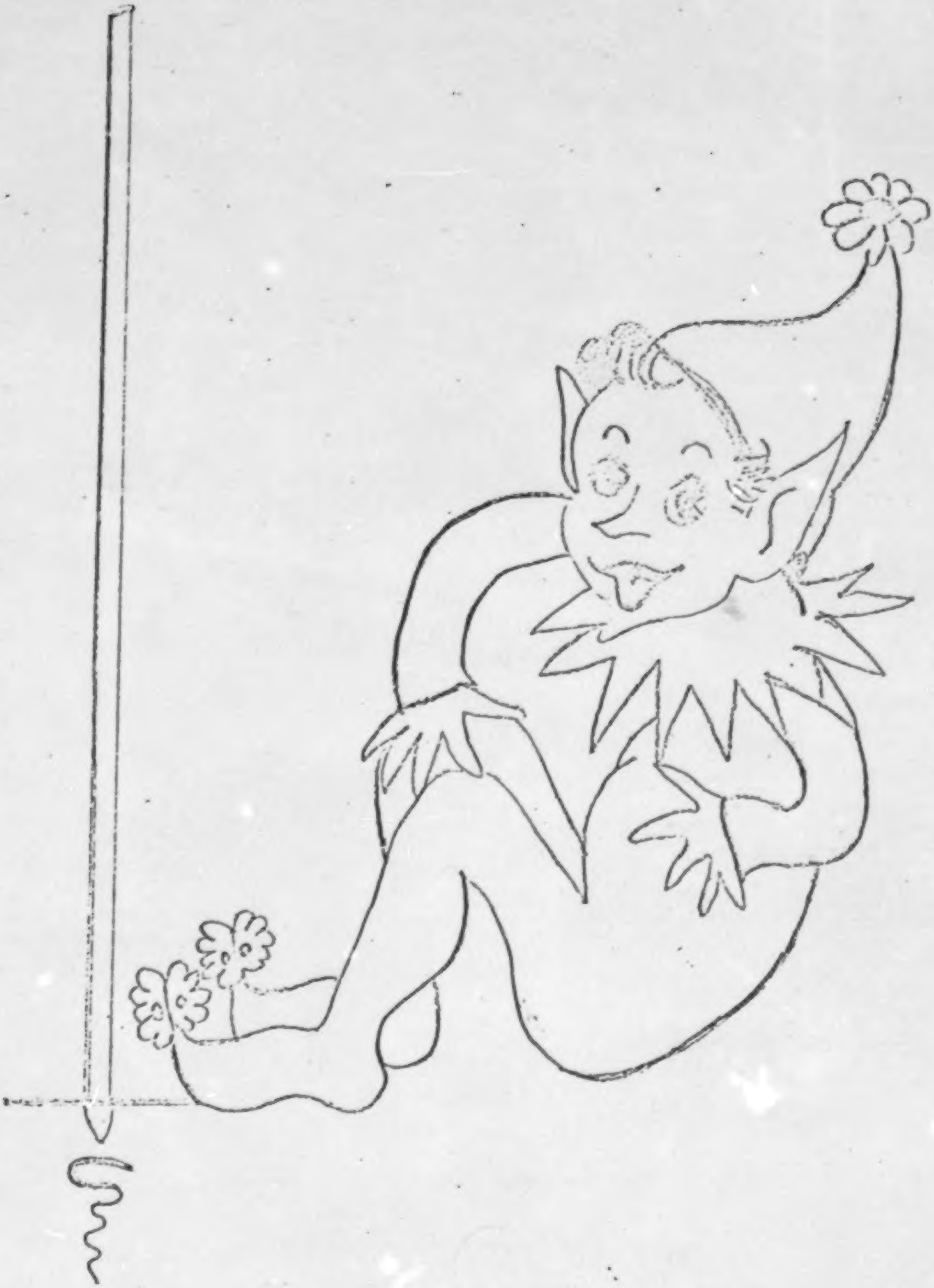


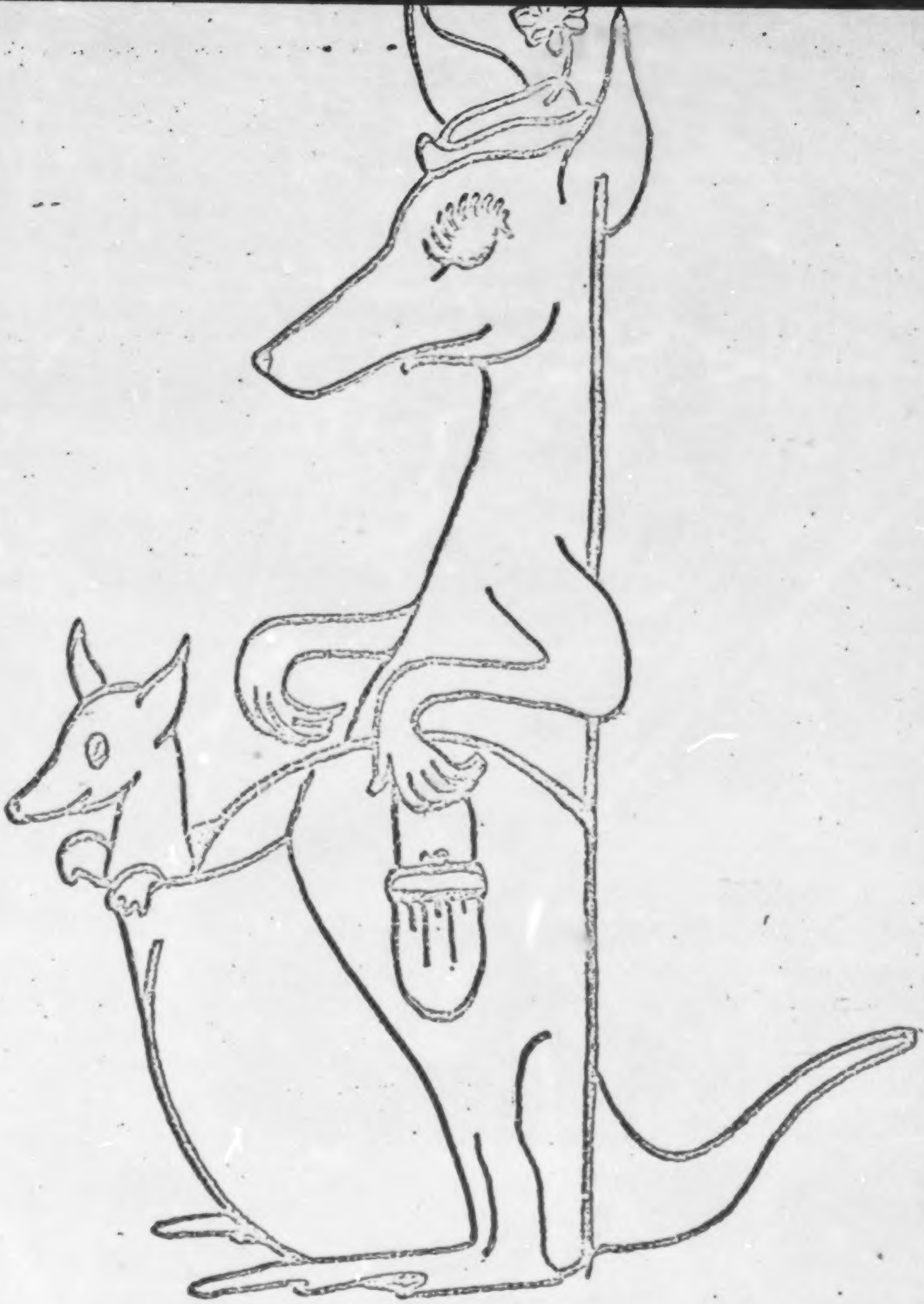


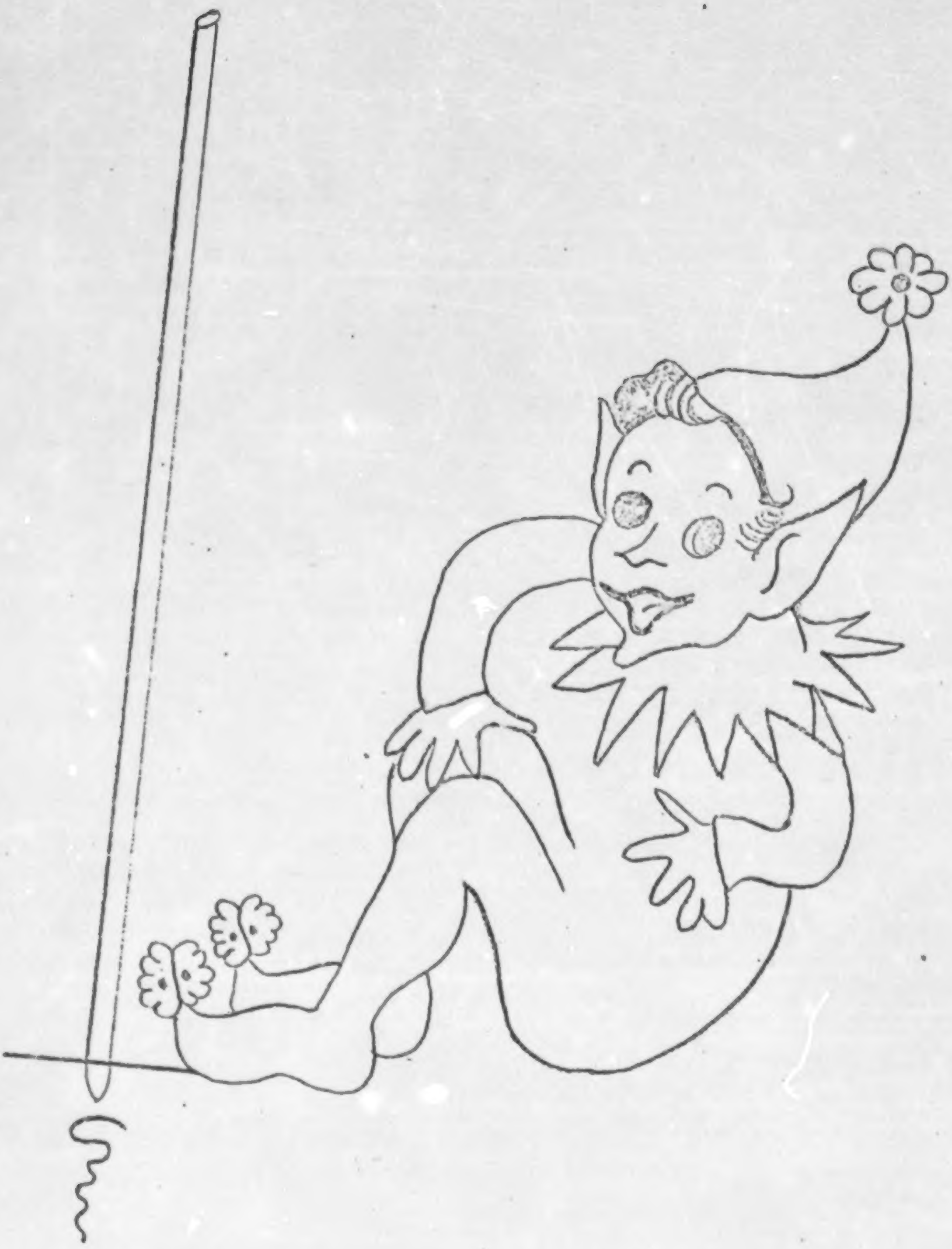


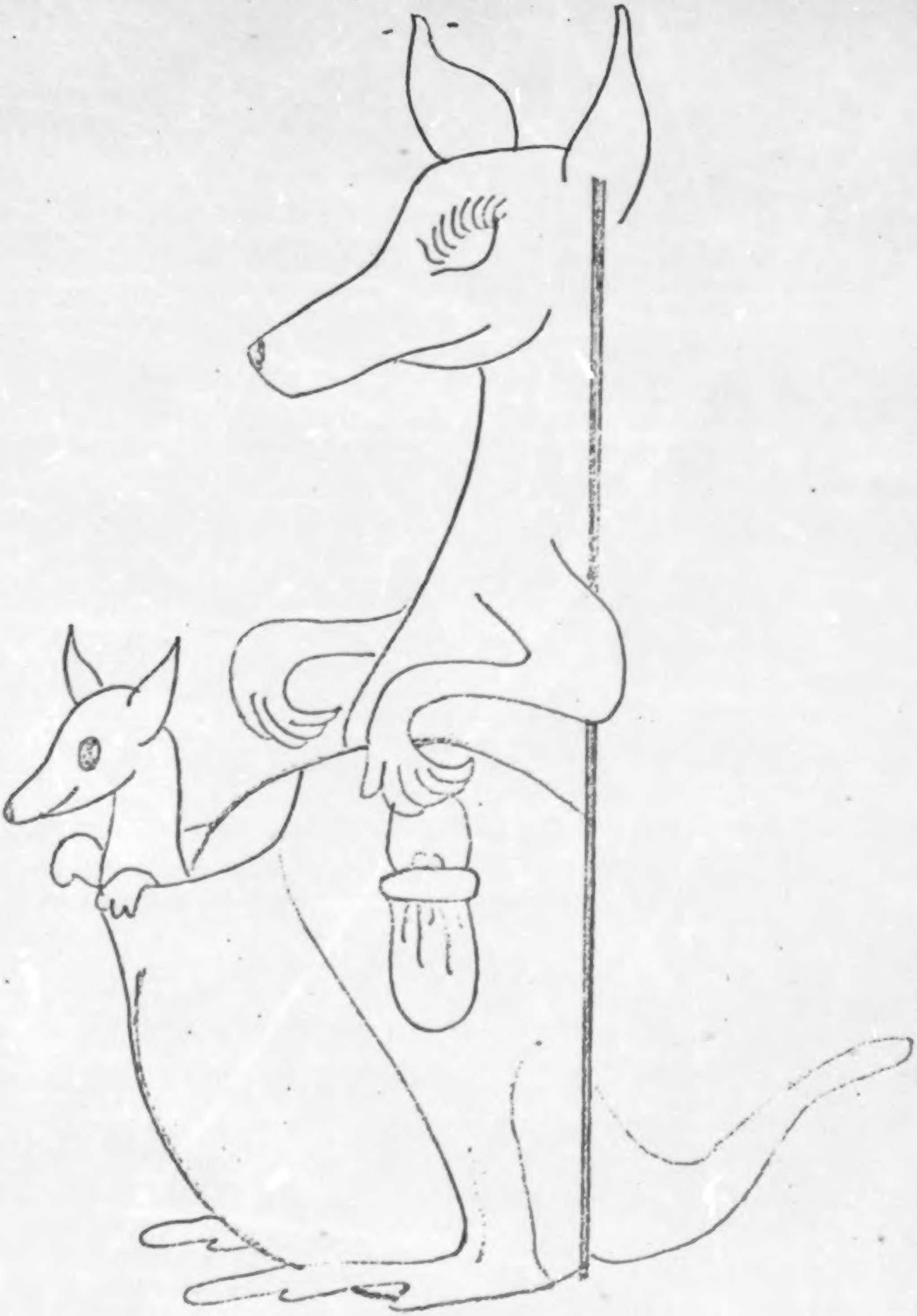


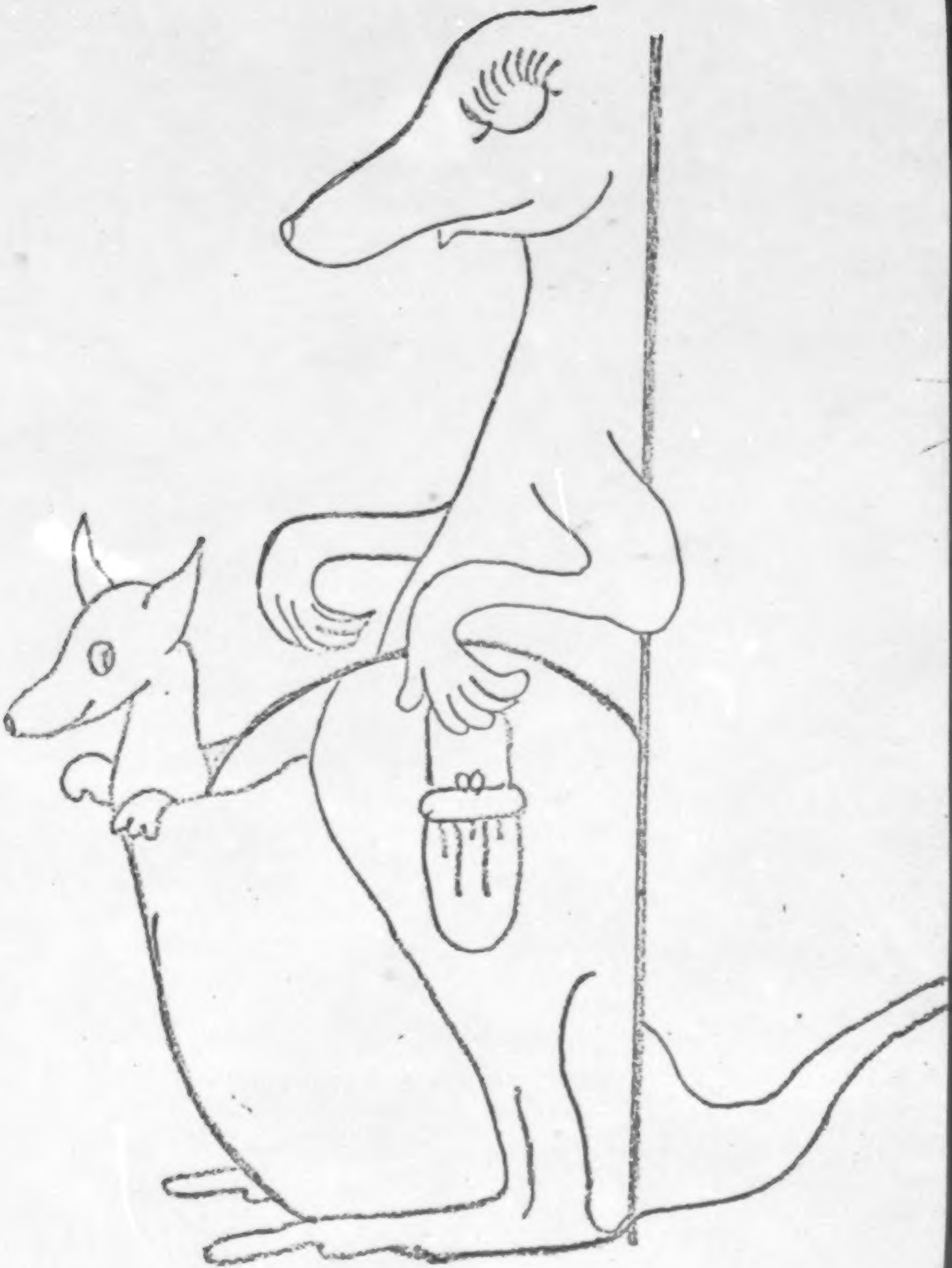


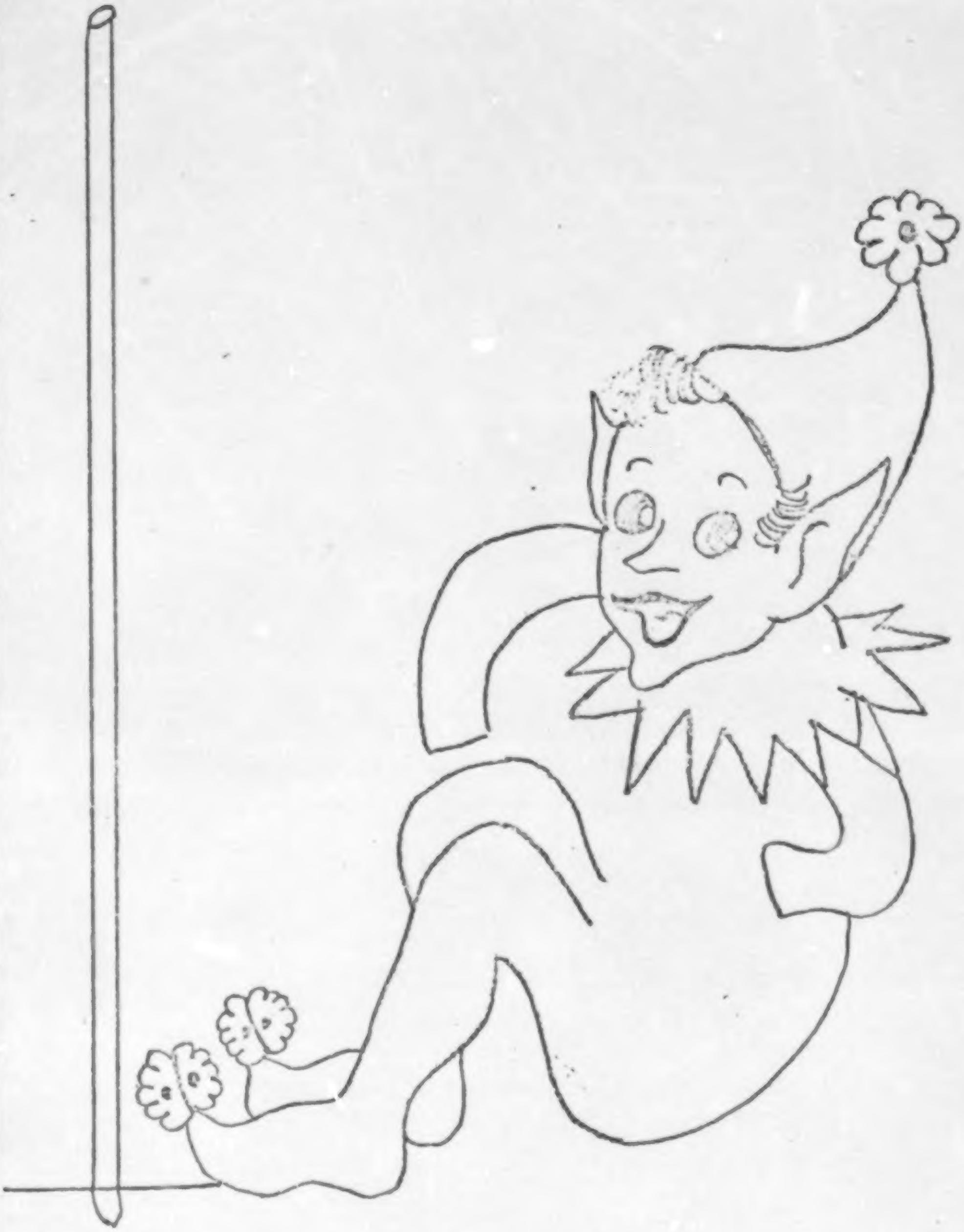


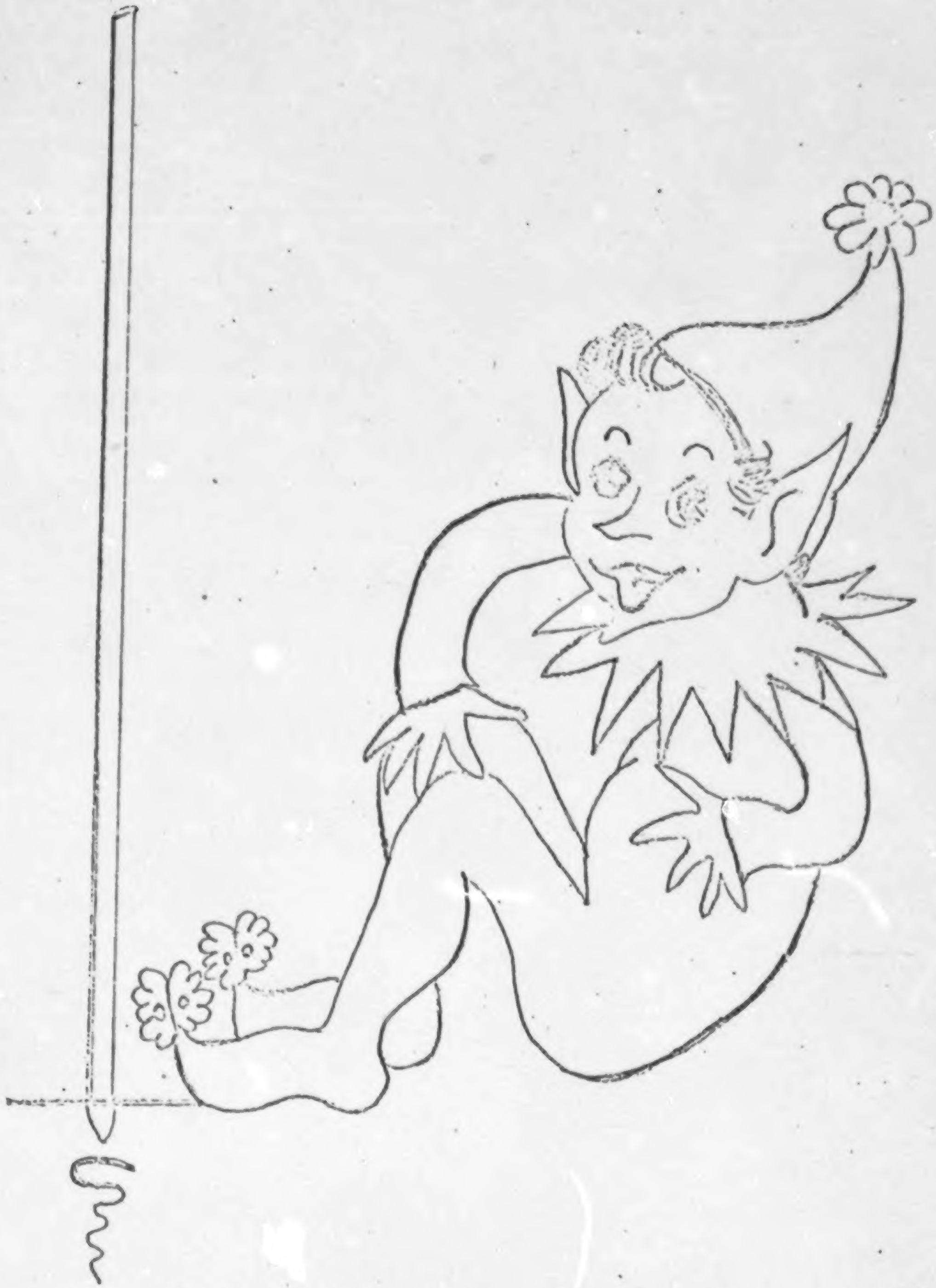


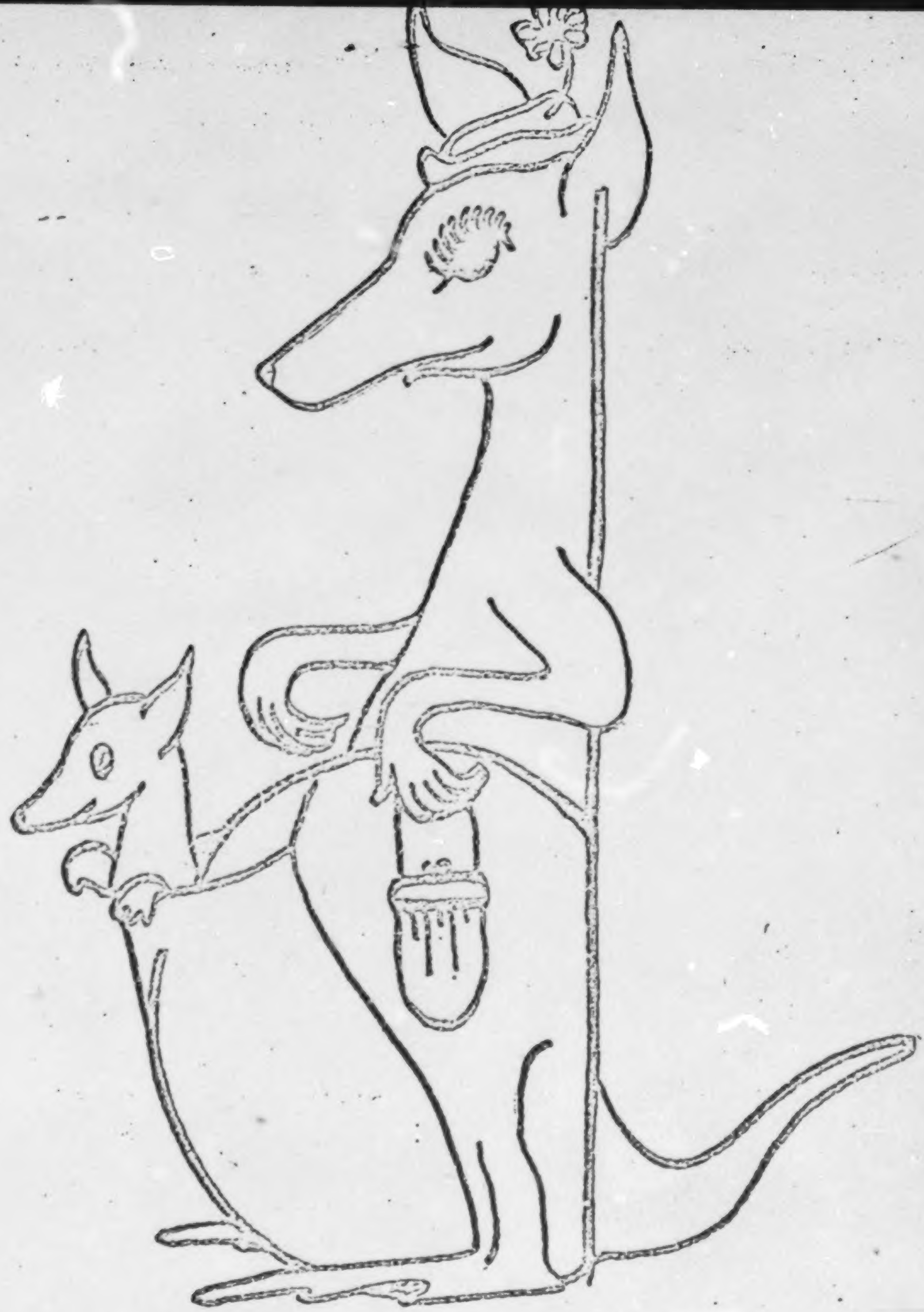


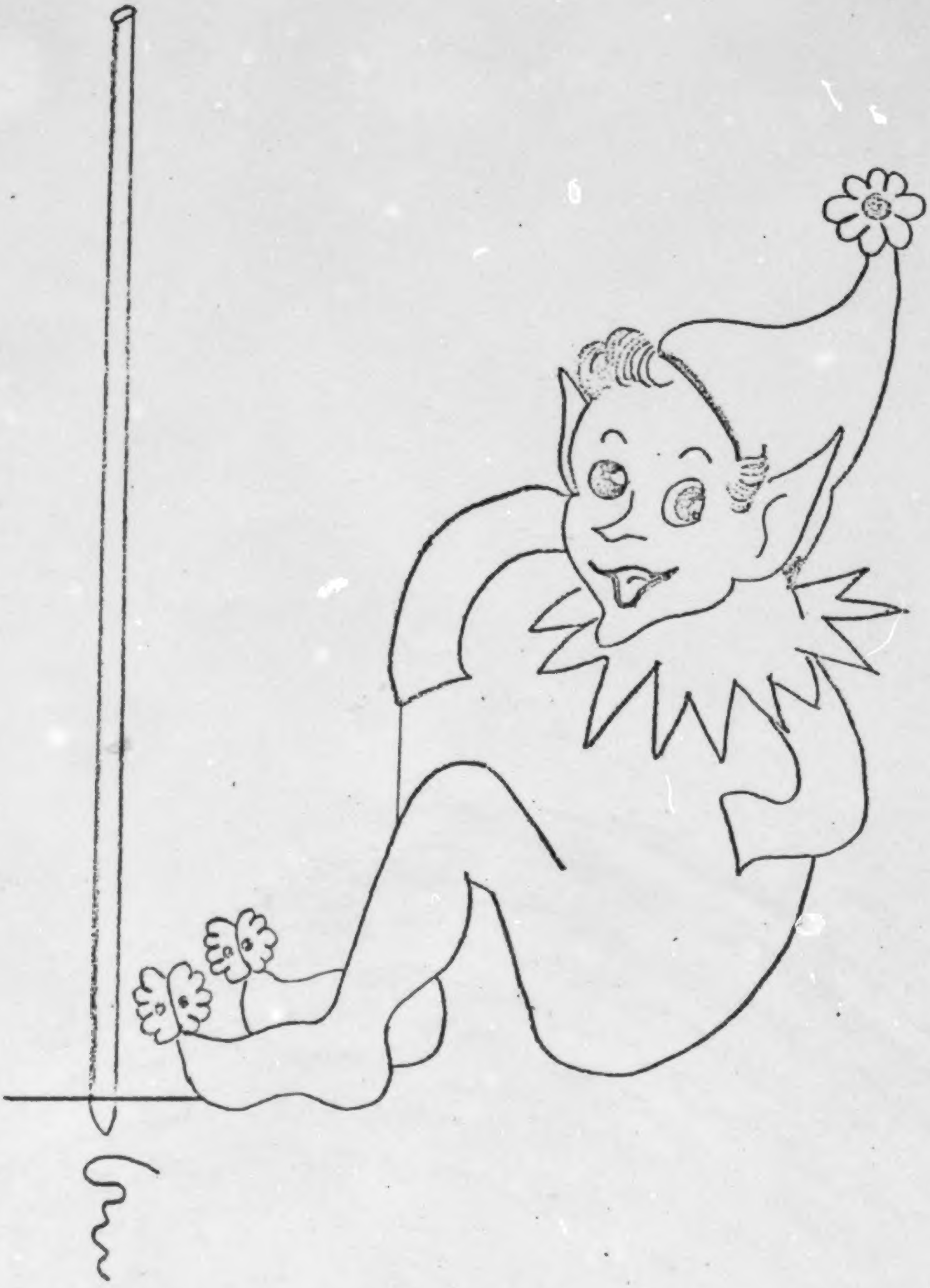


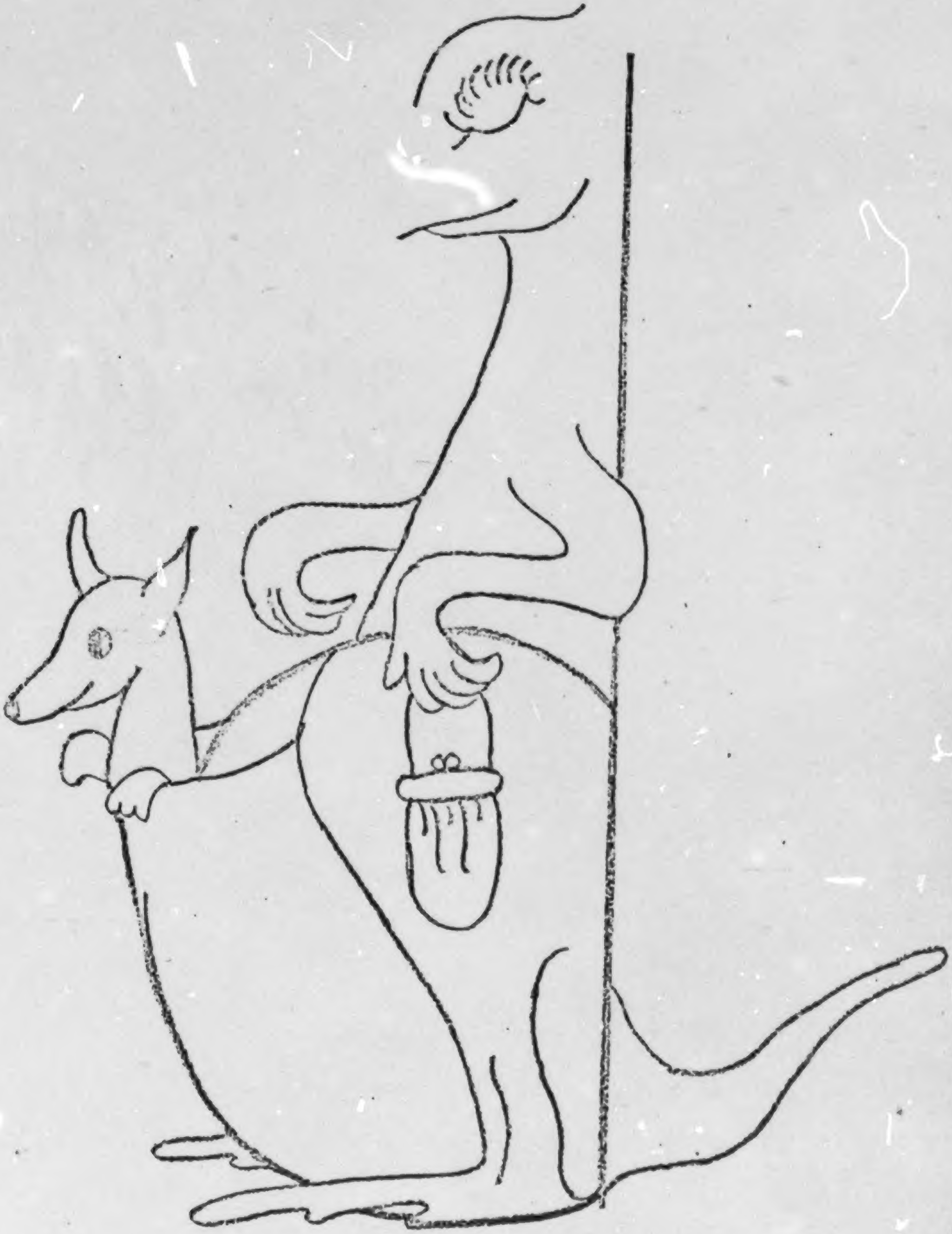


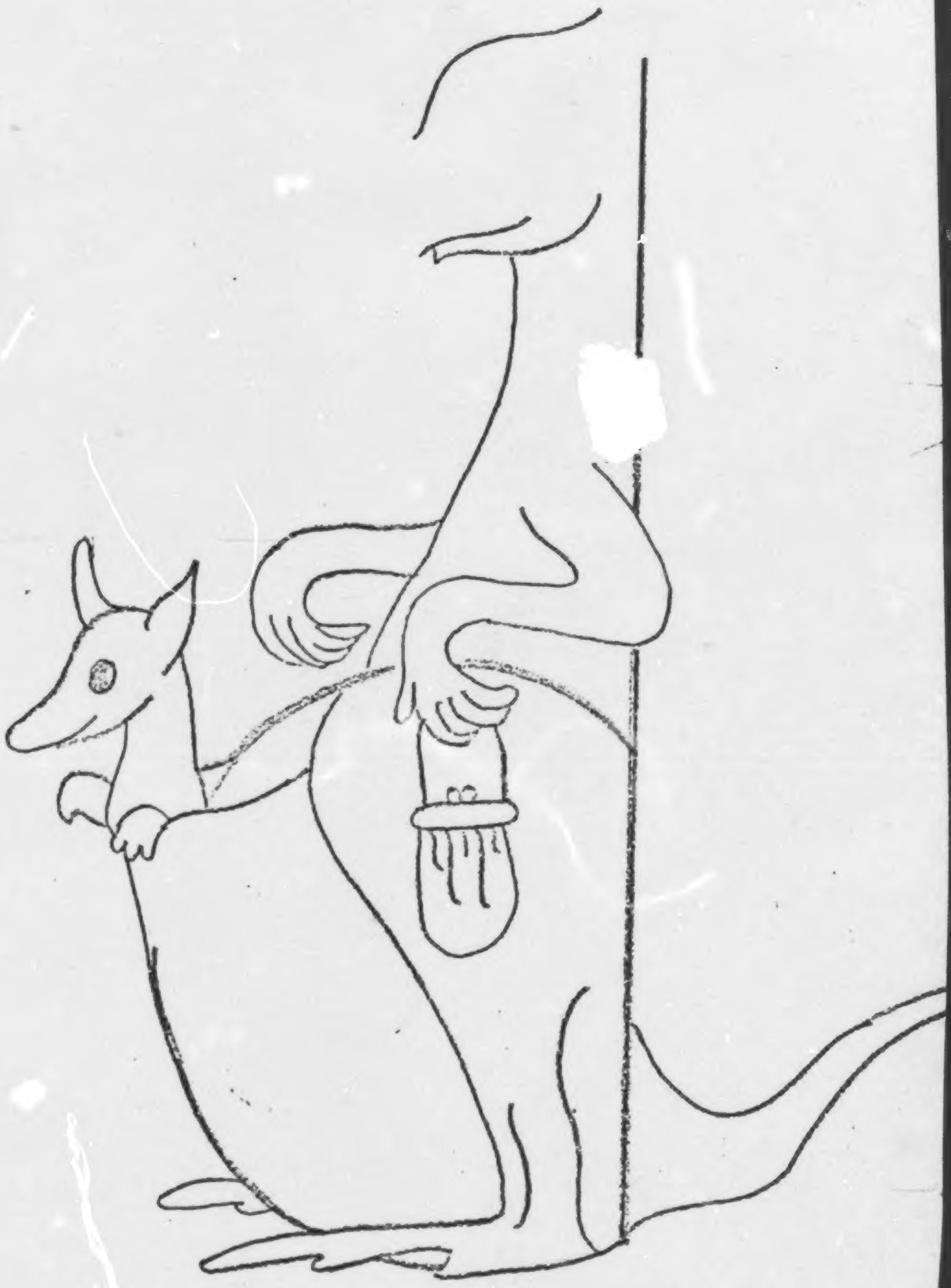


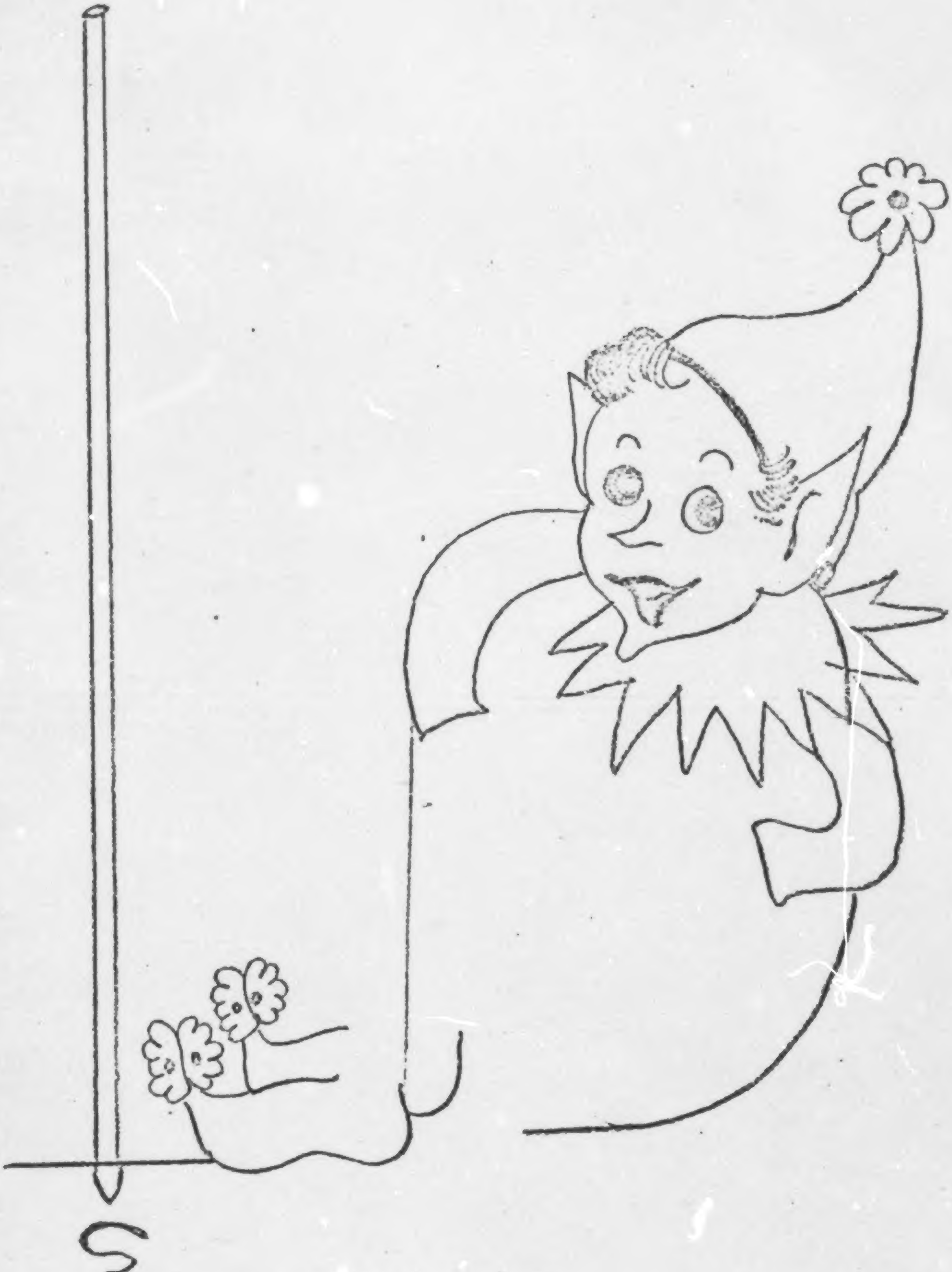


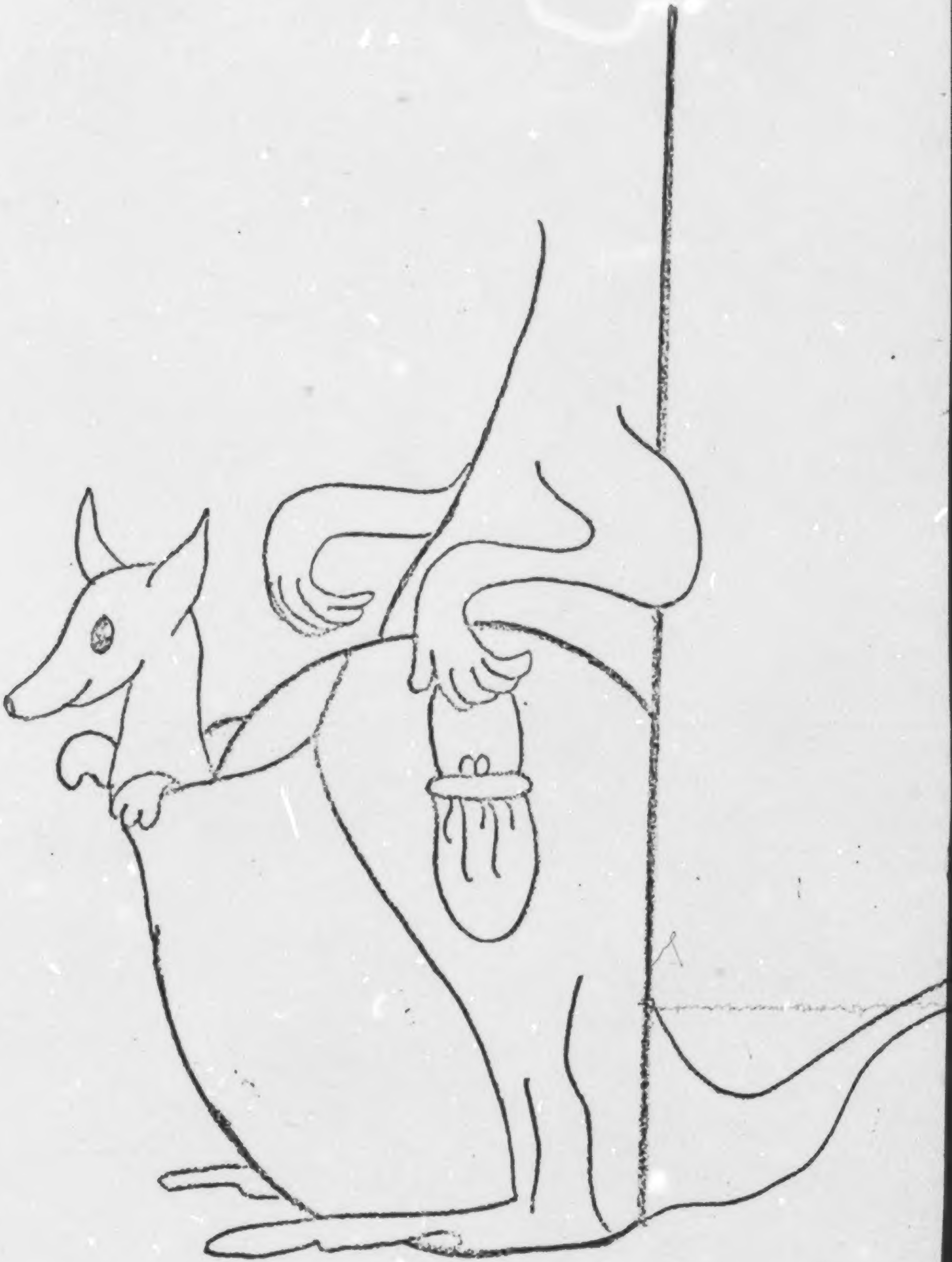


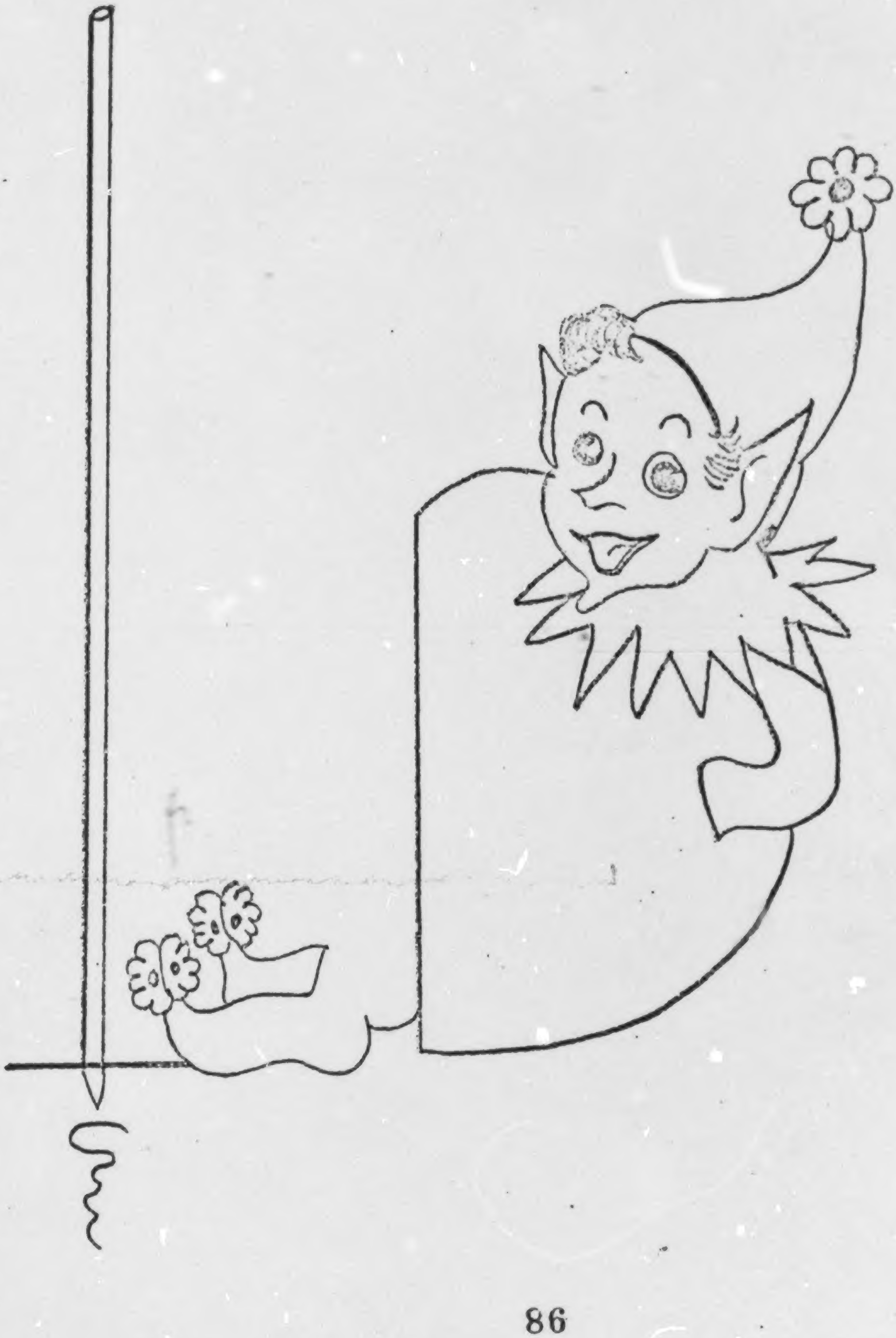


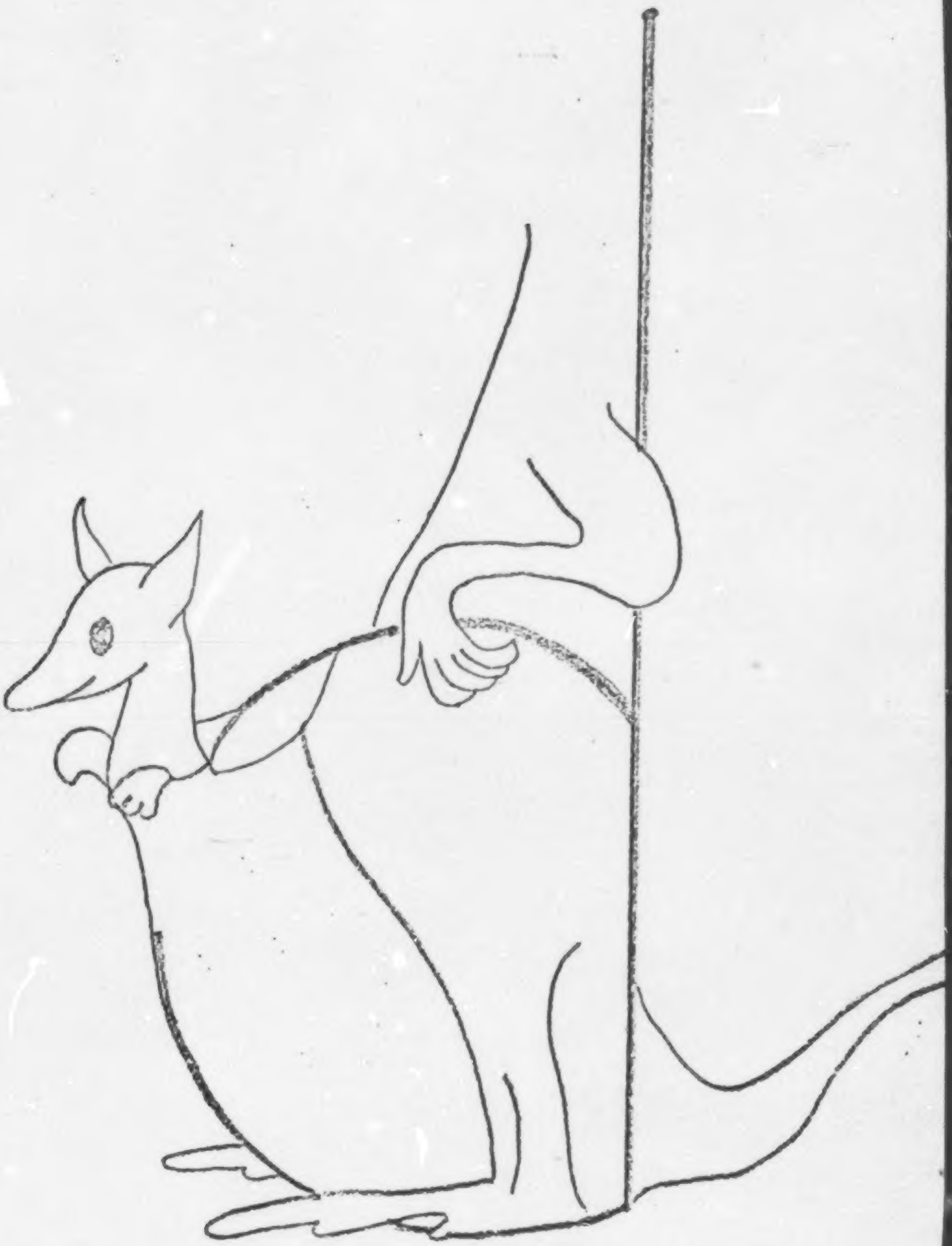


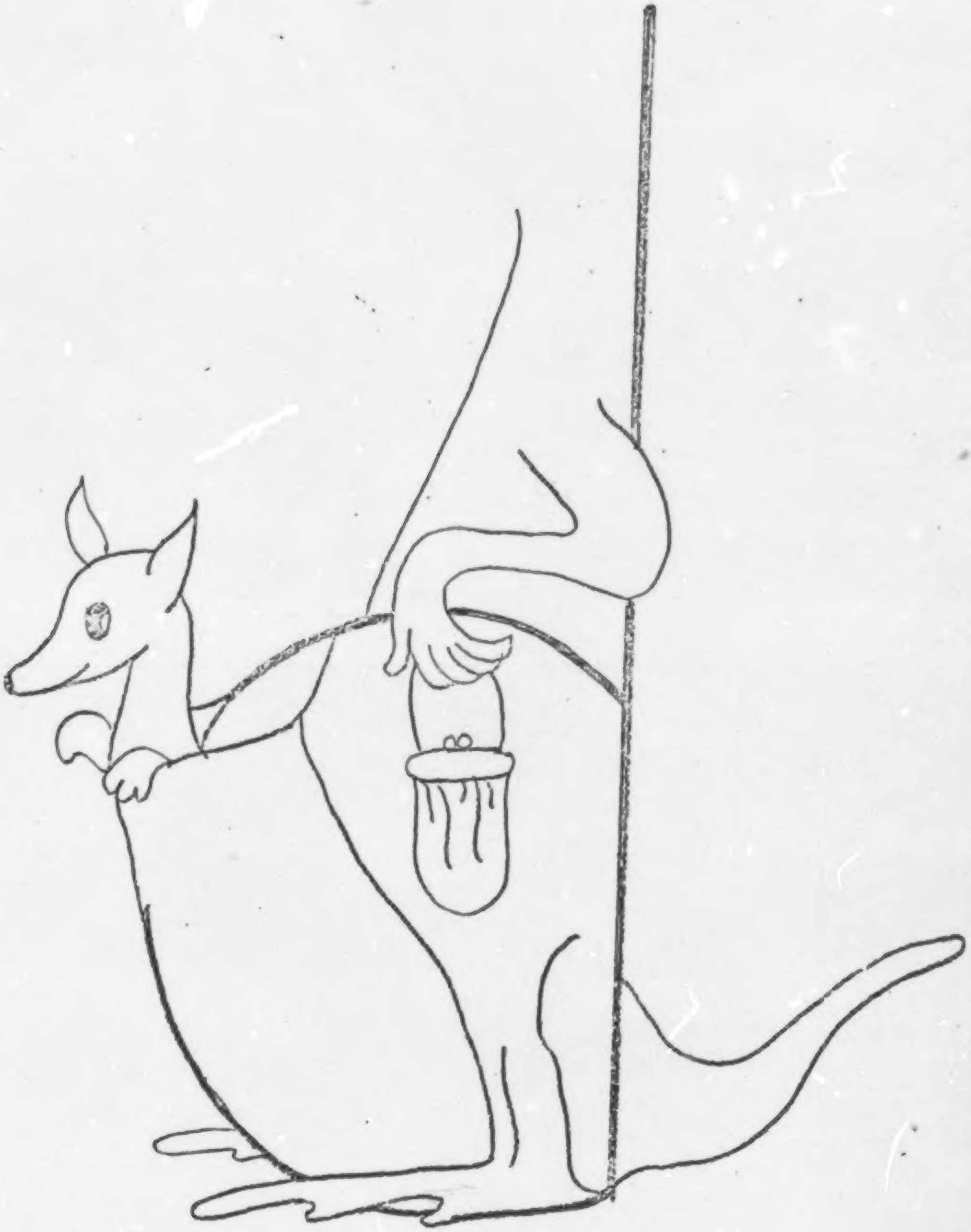


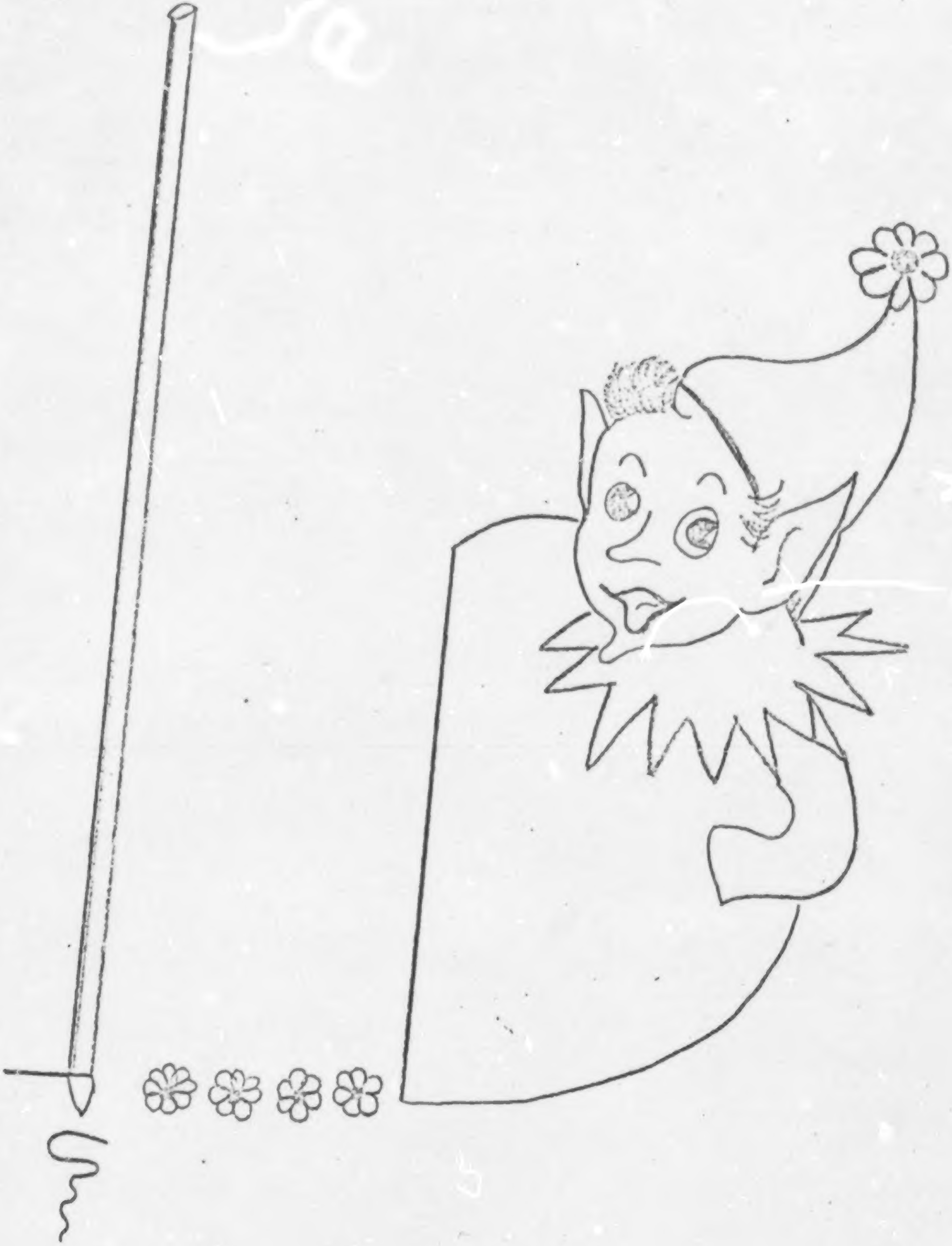


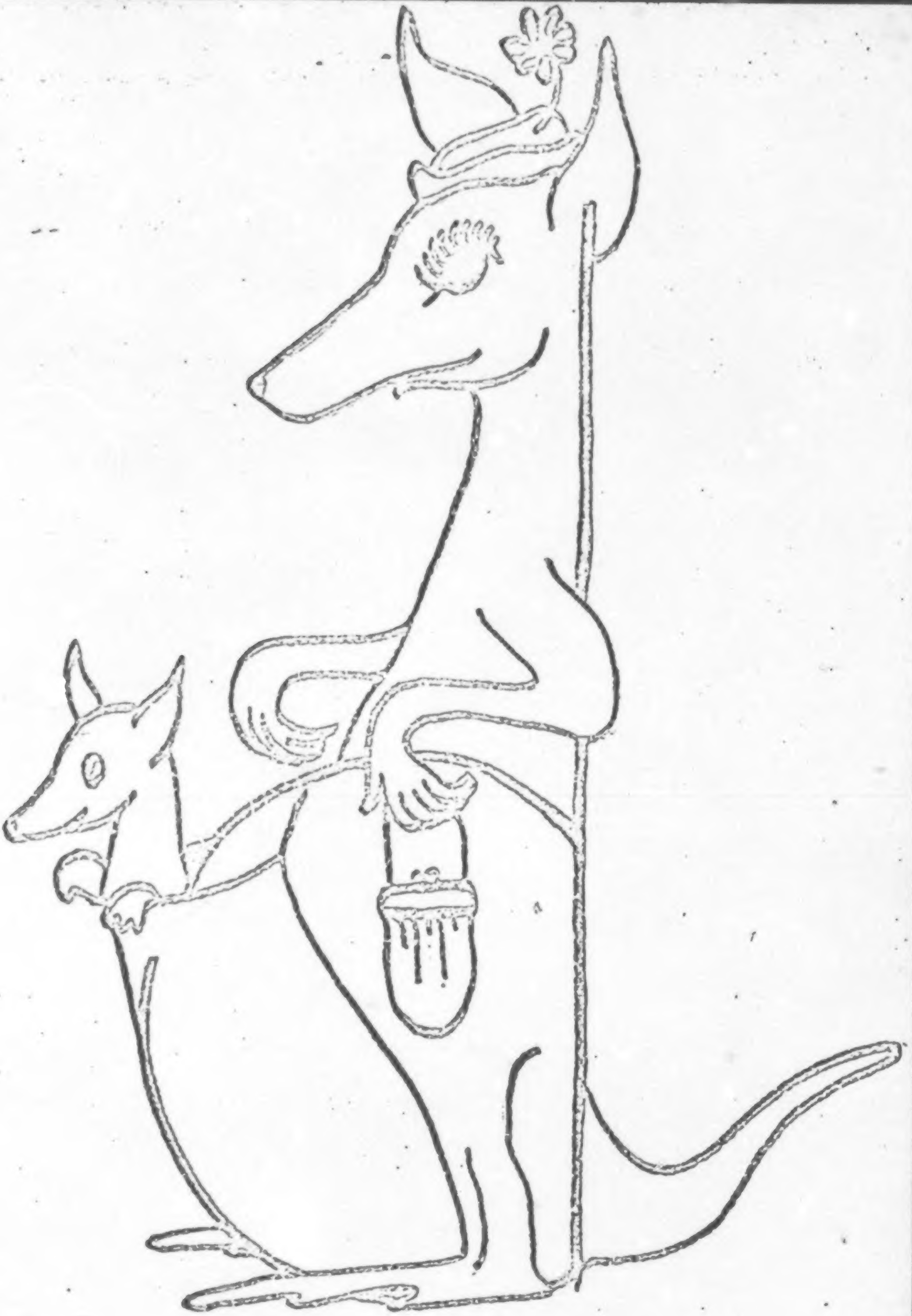


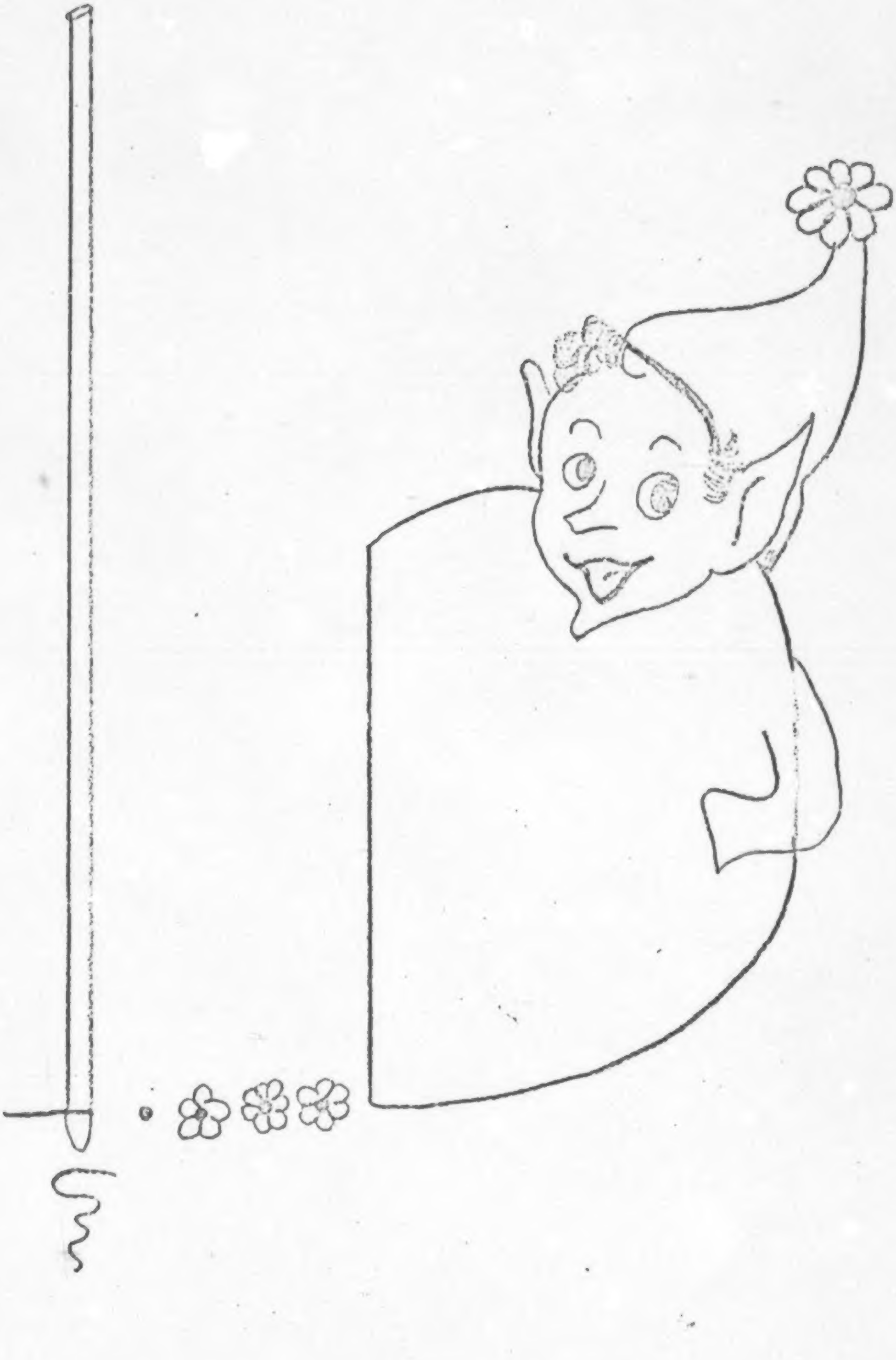


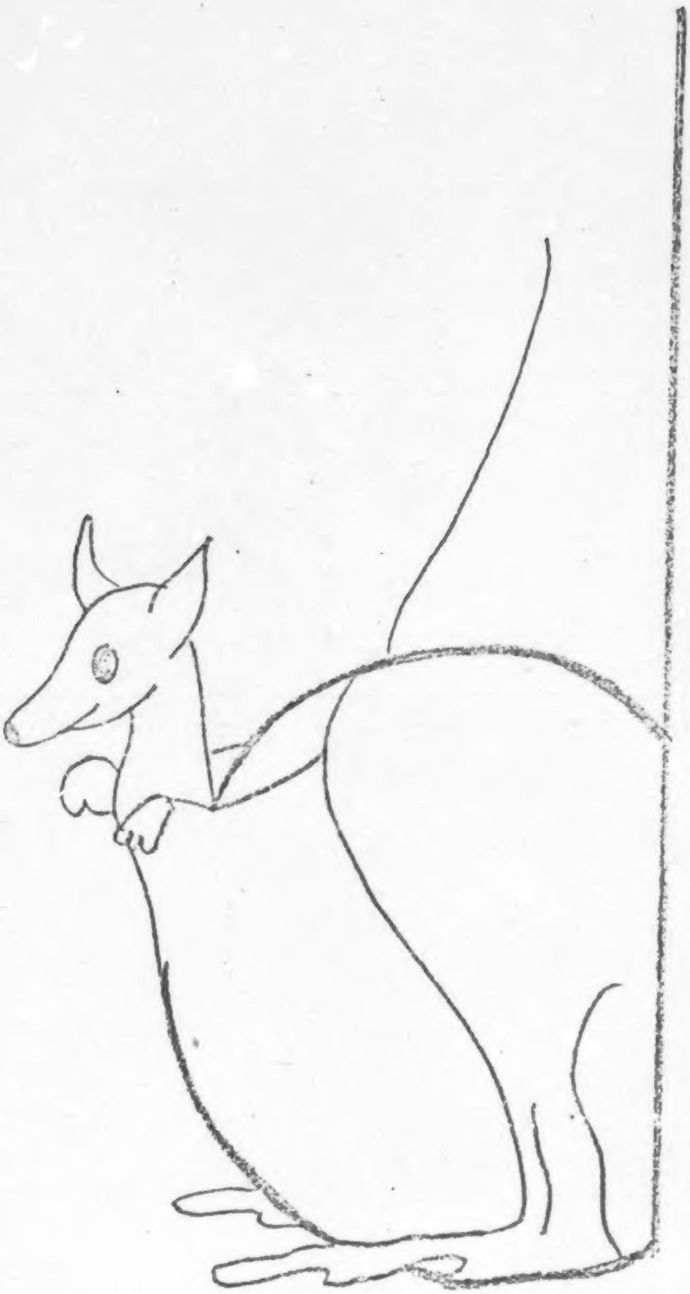


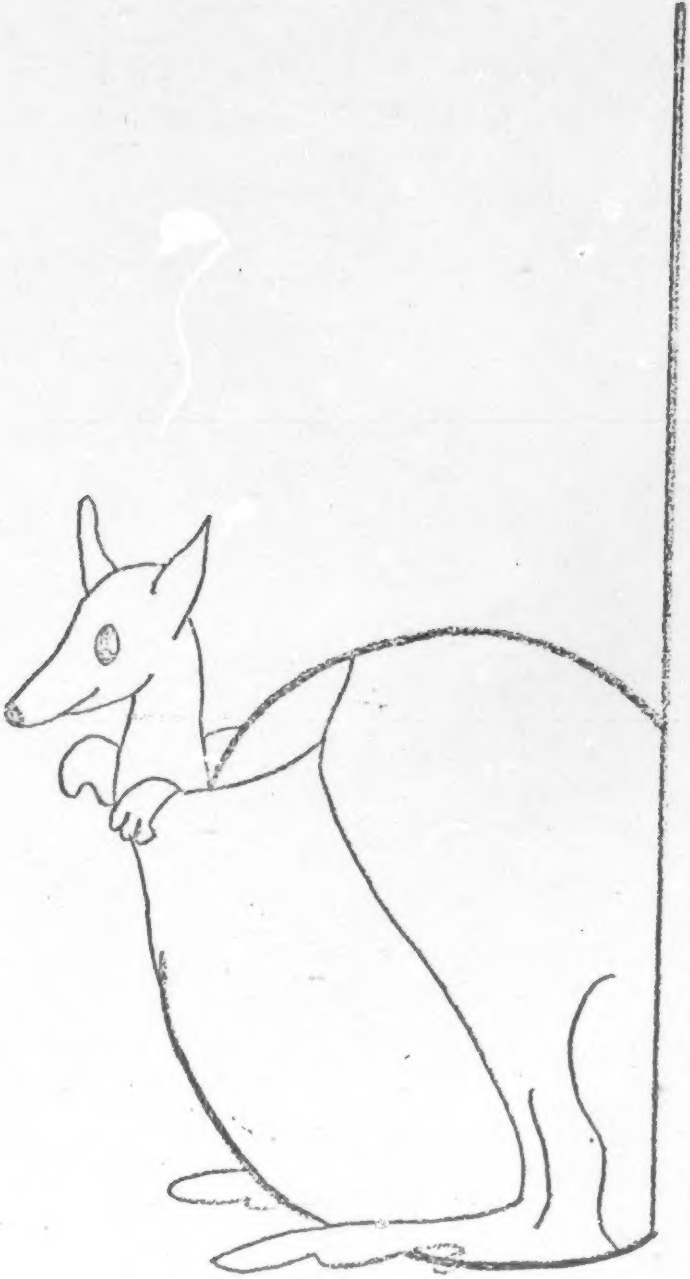


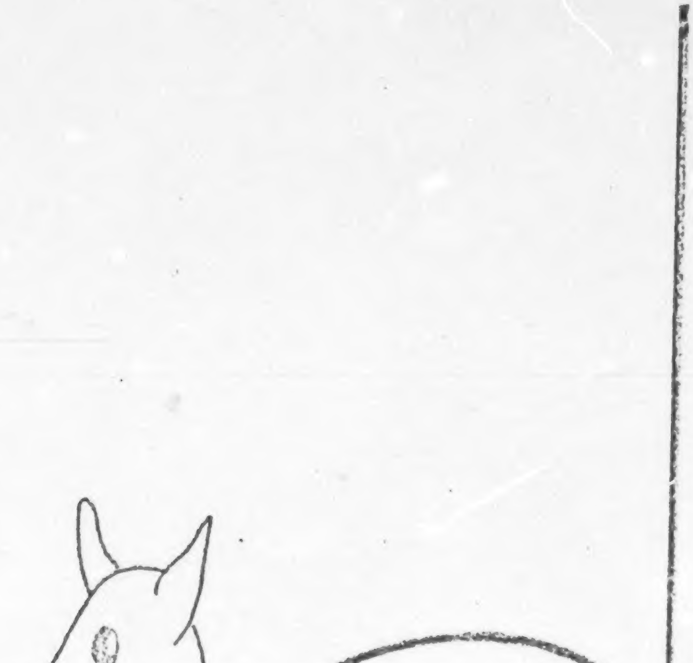

Un

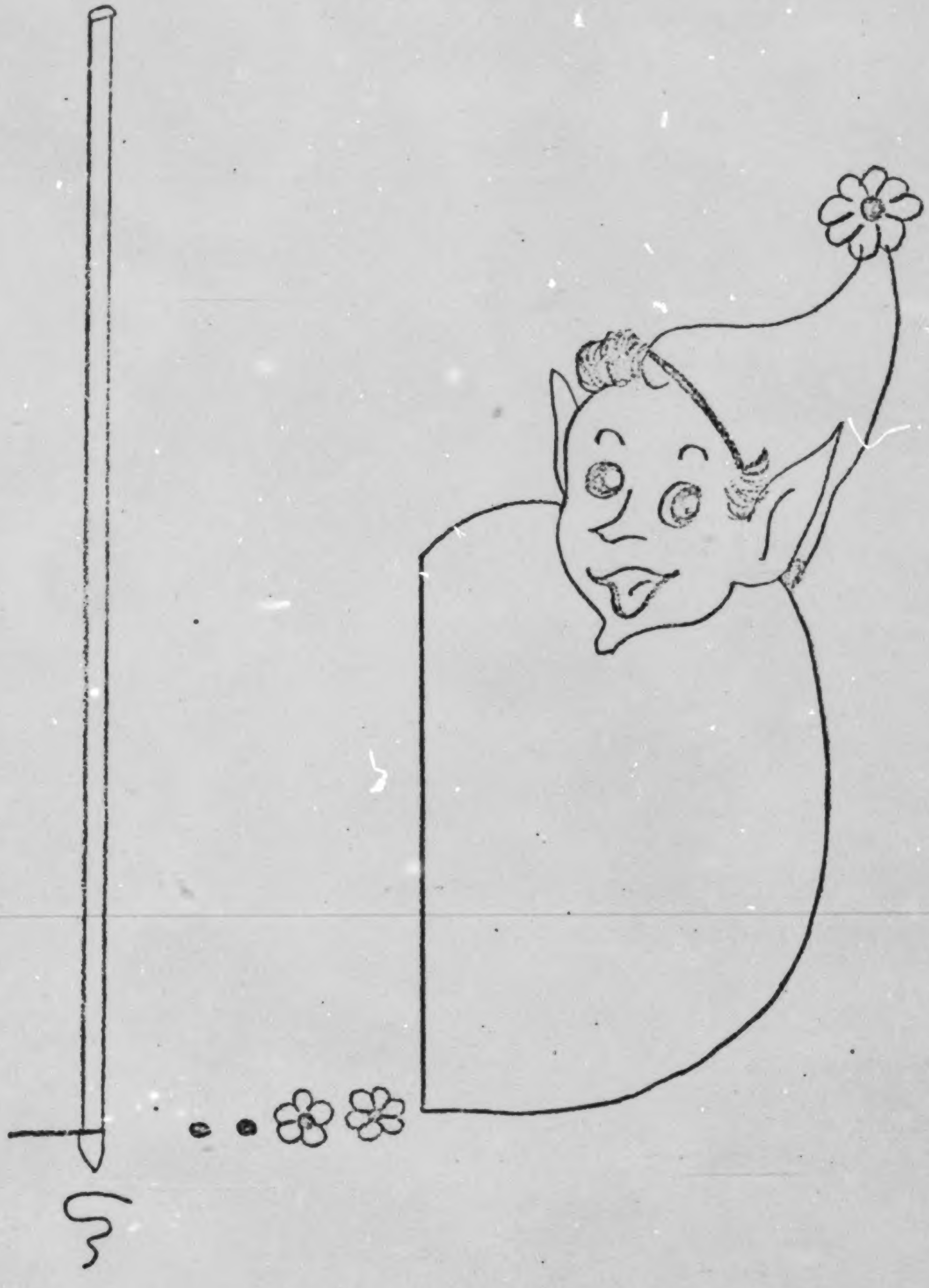


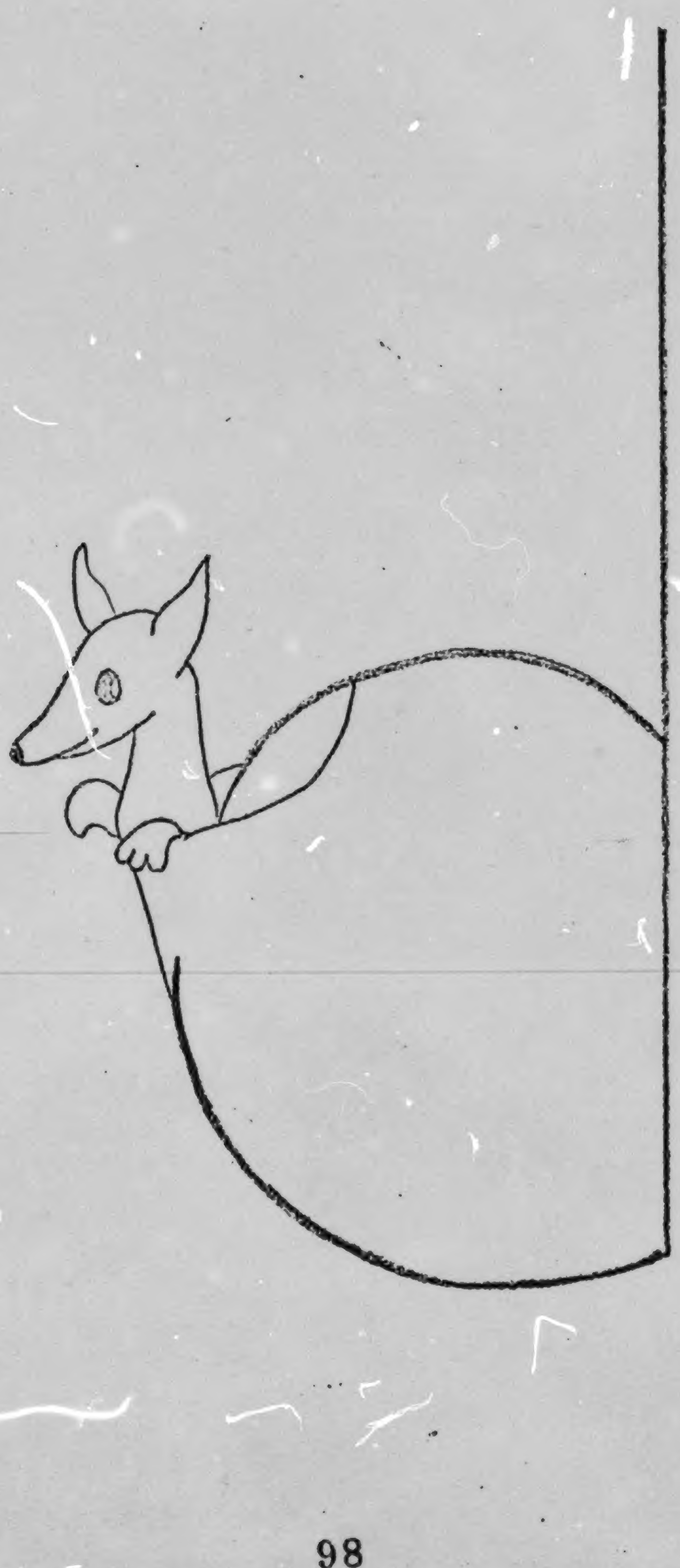


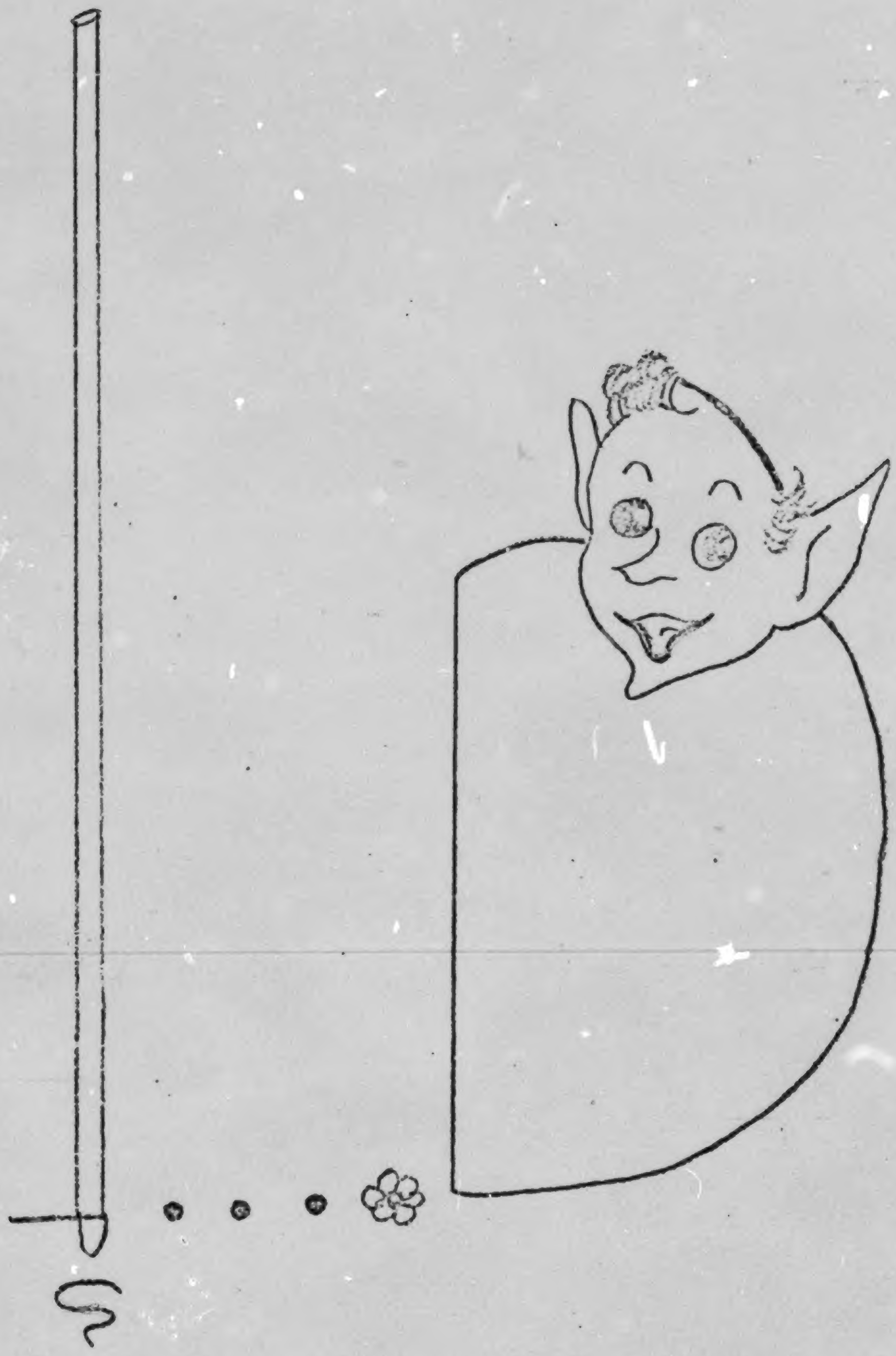


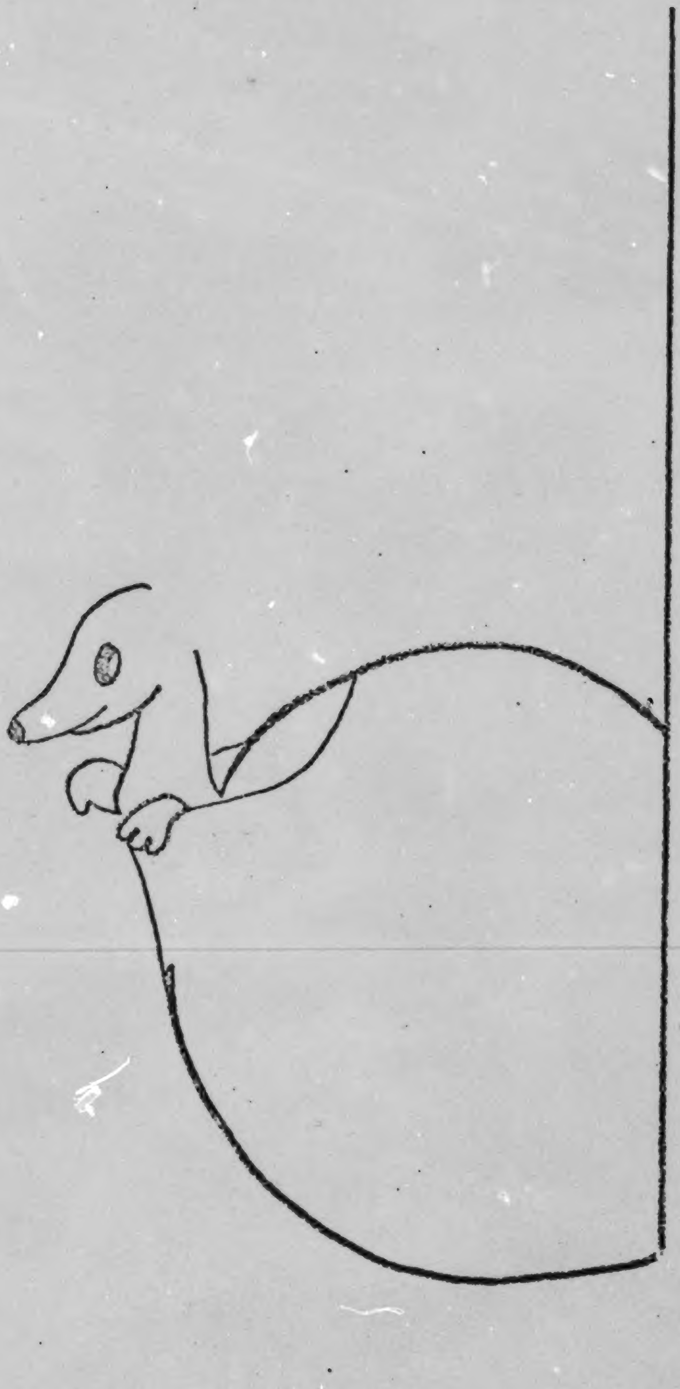


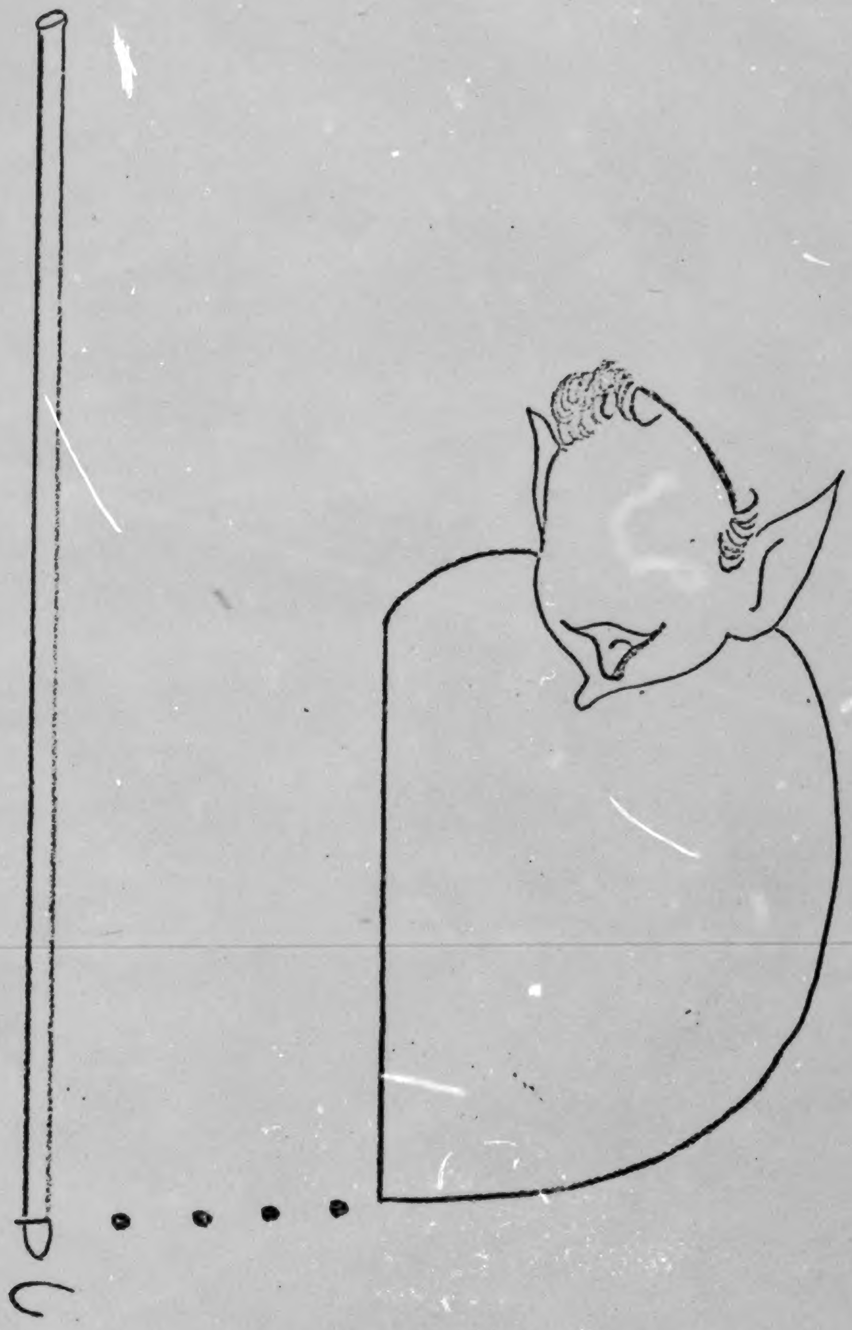


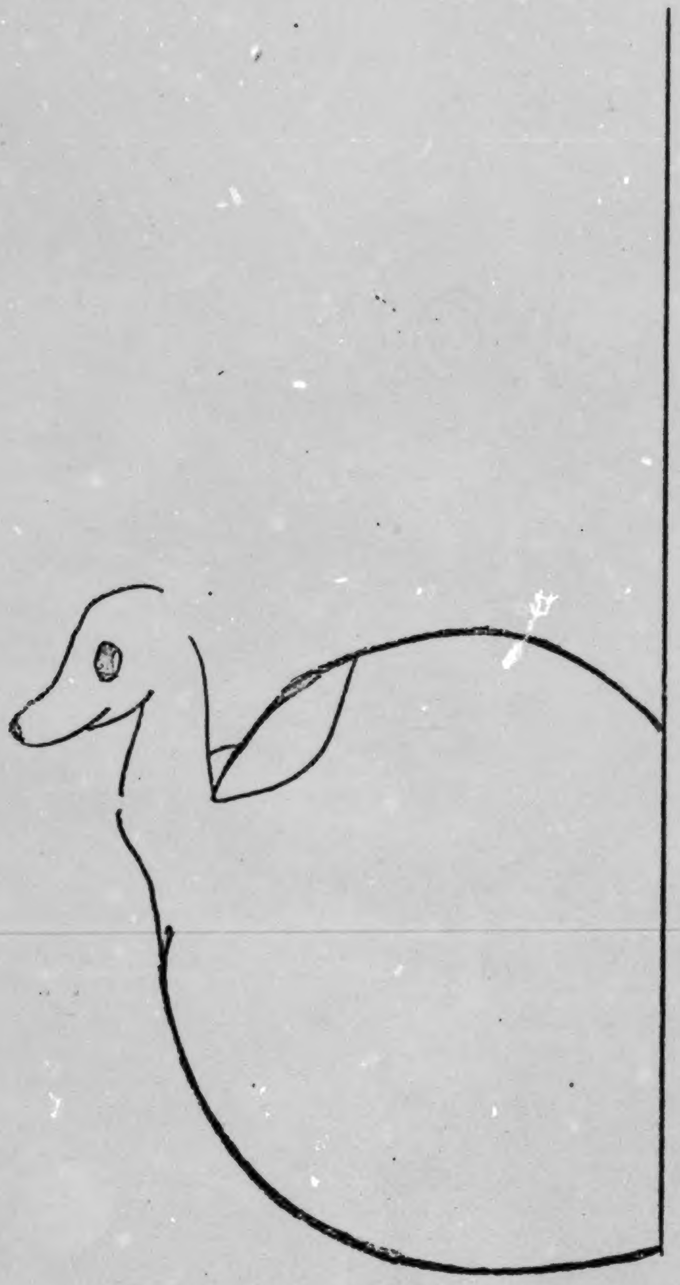


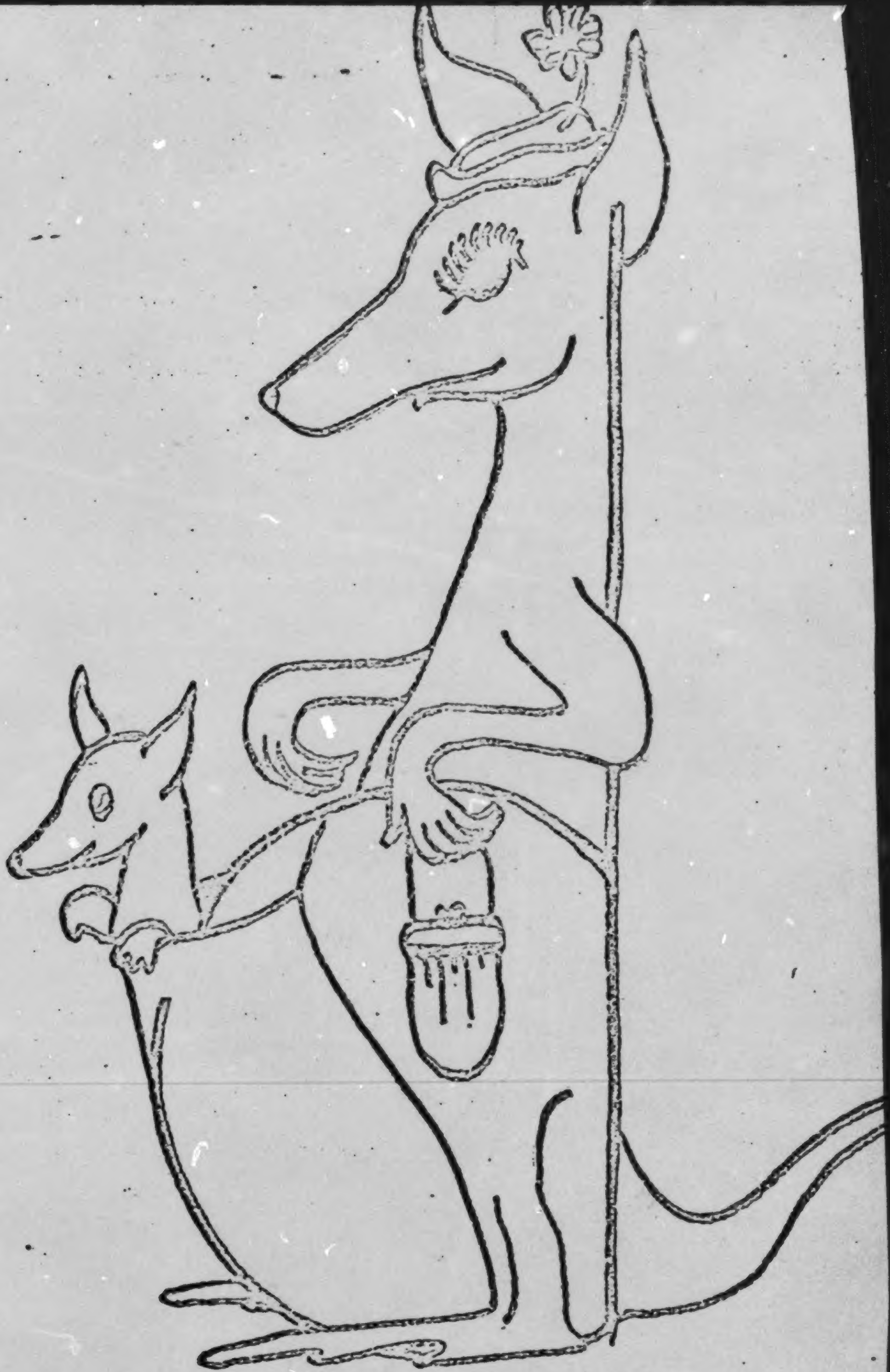


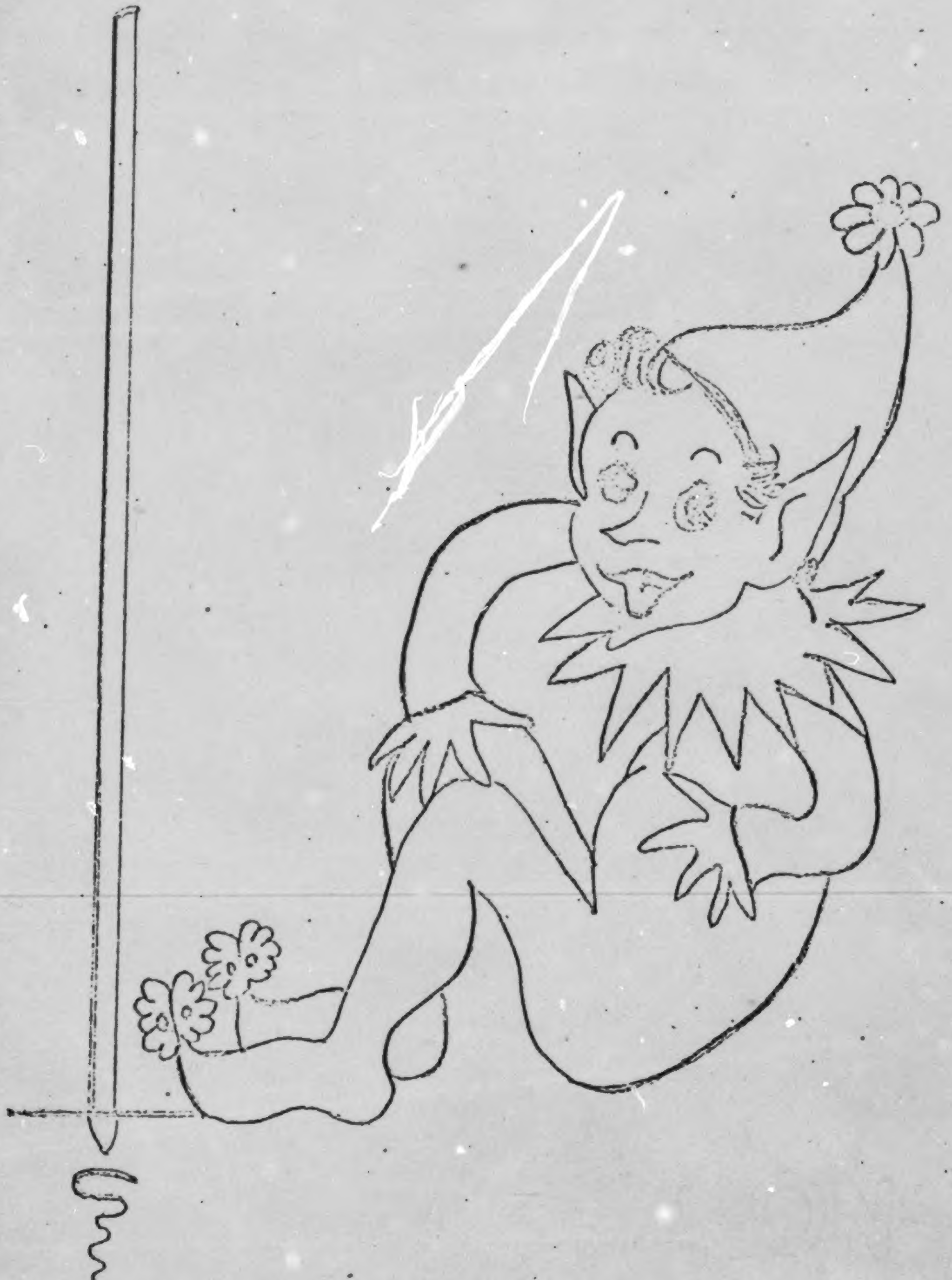


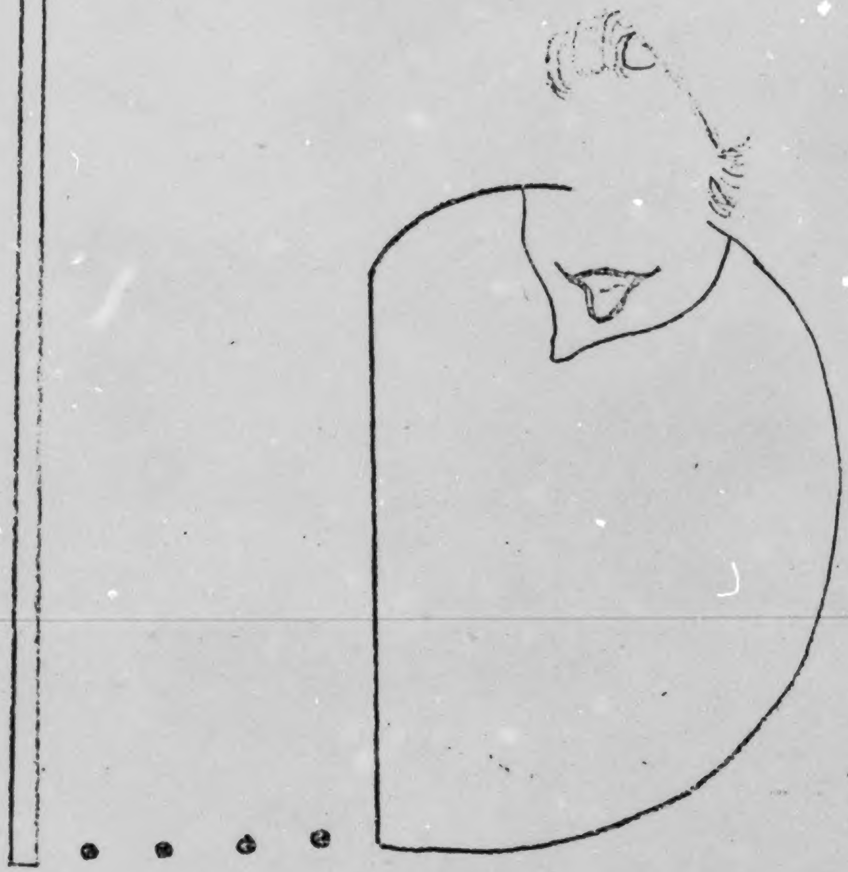


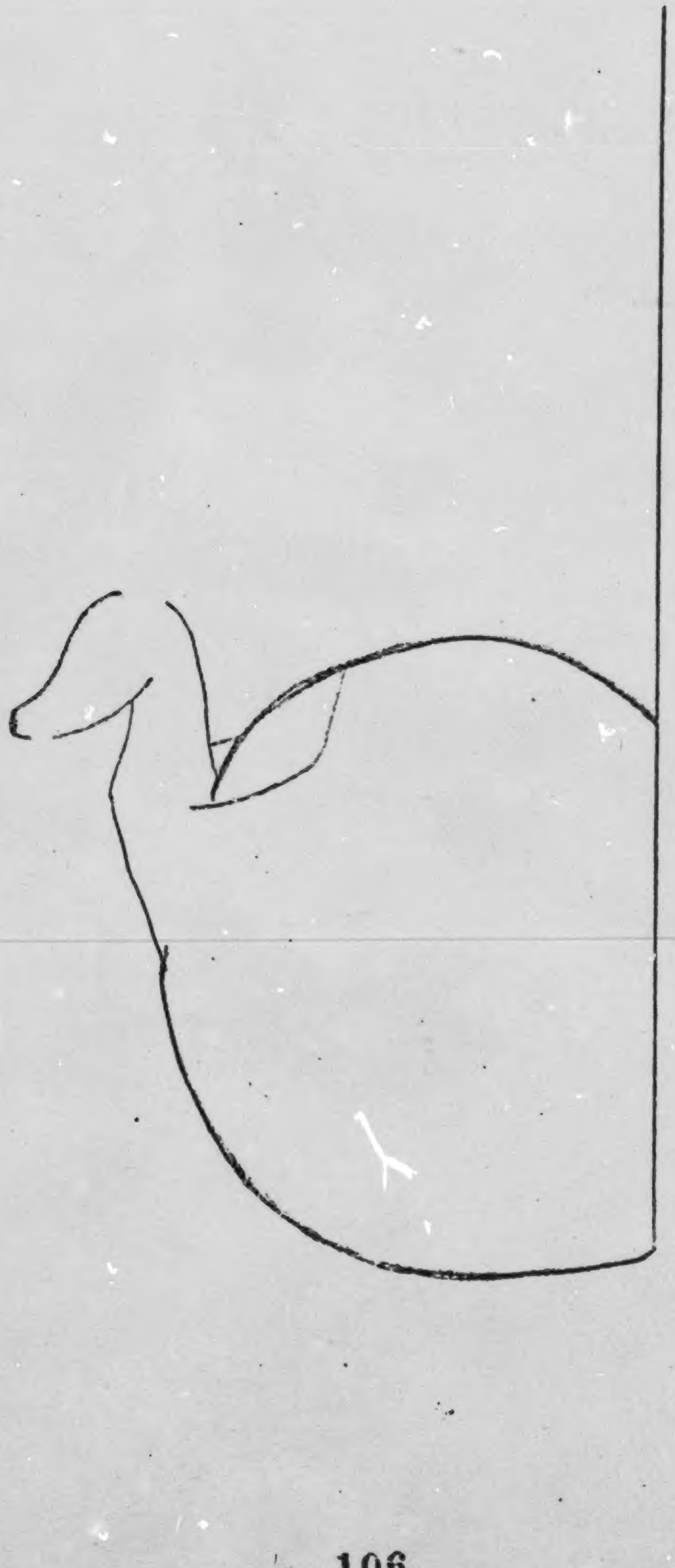


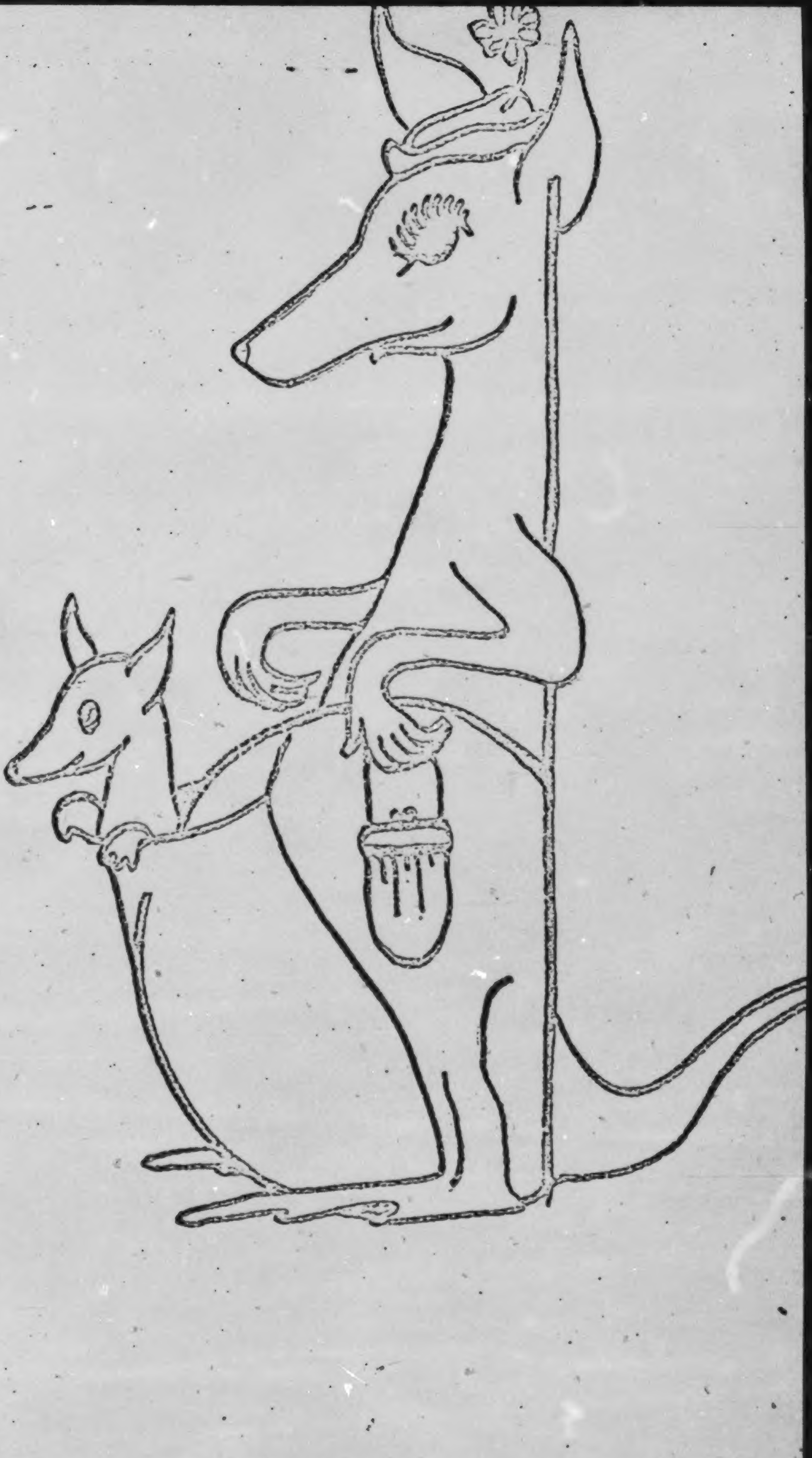


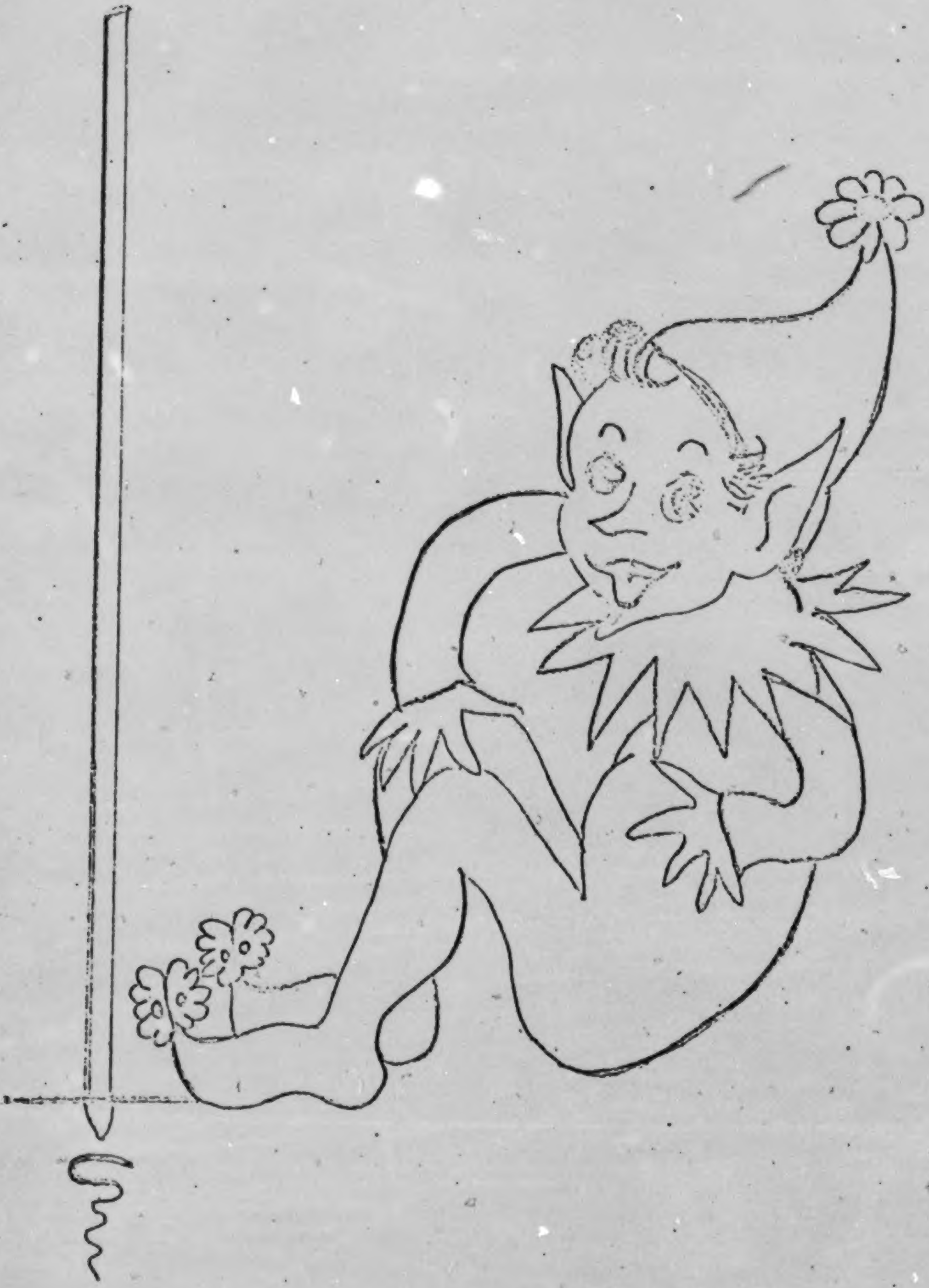


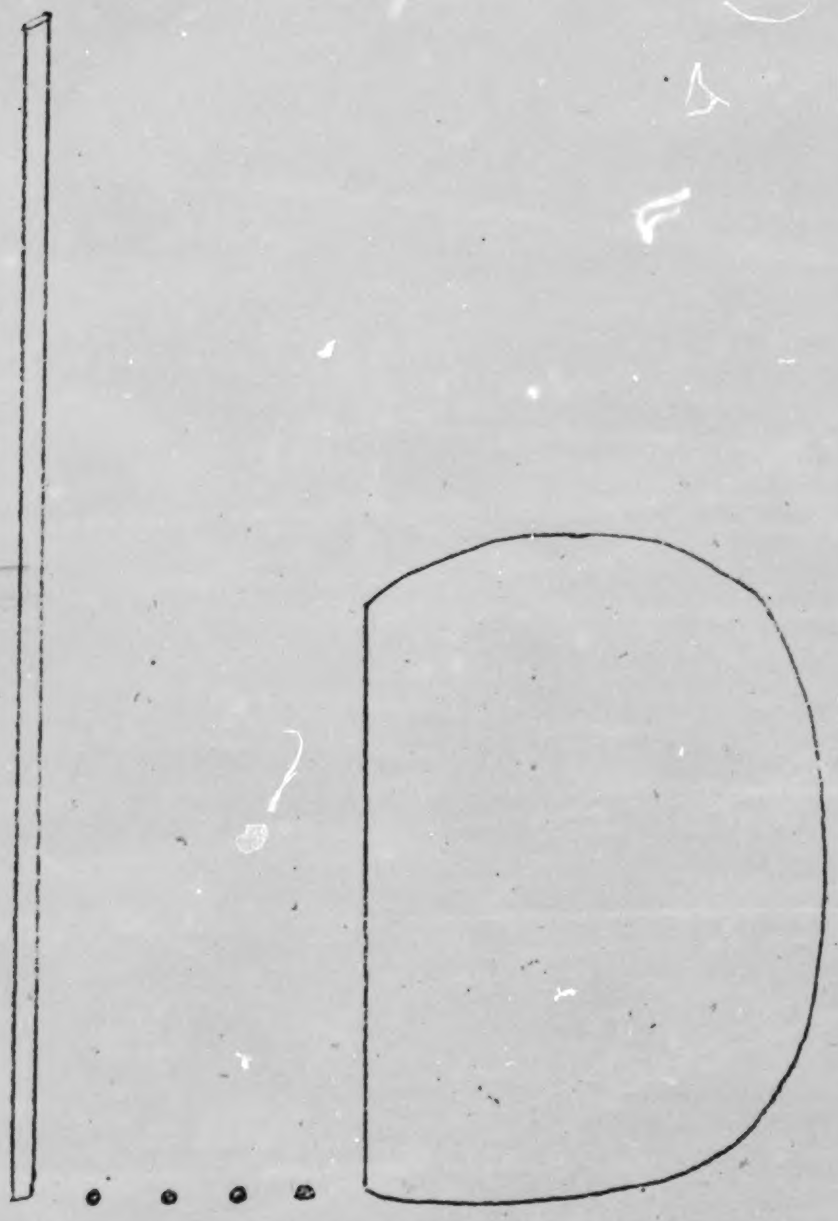


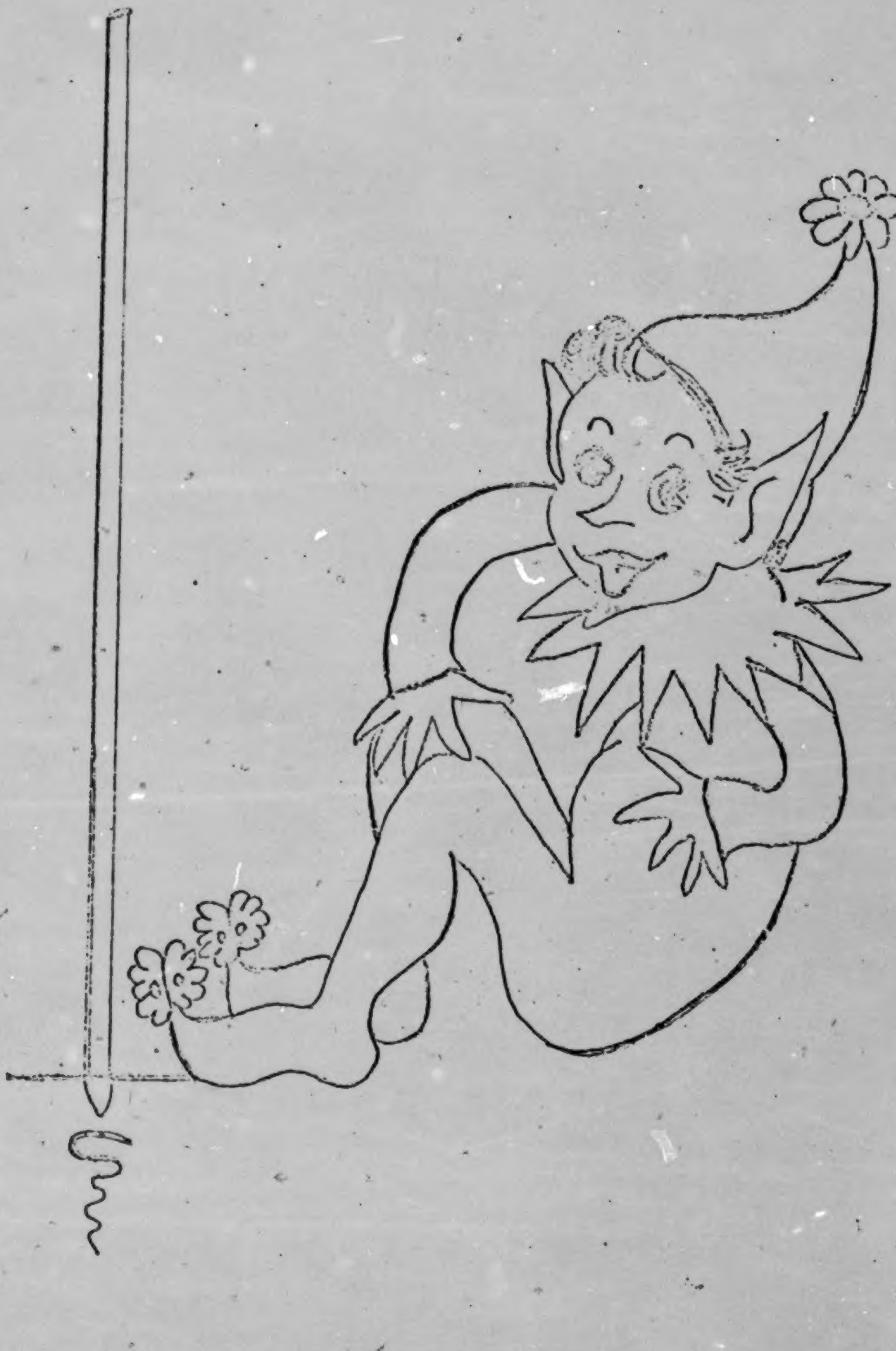


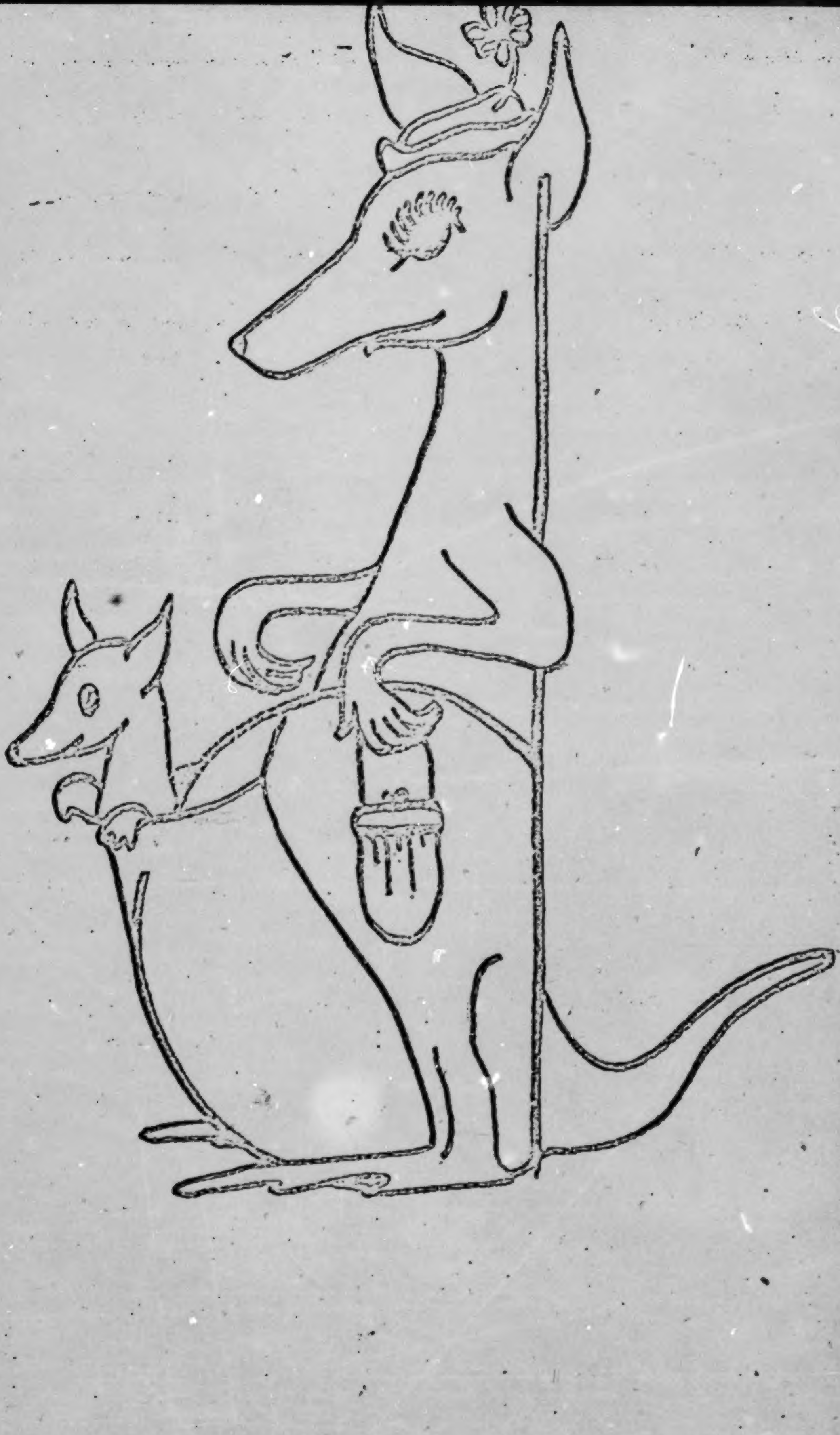


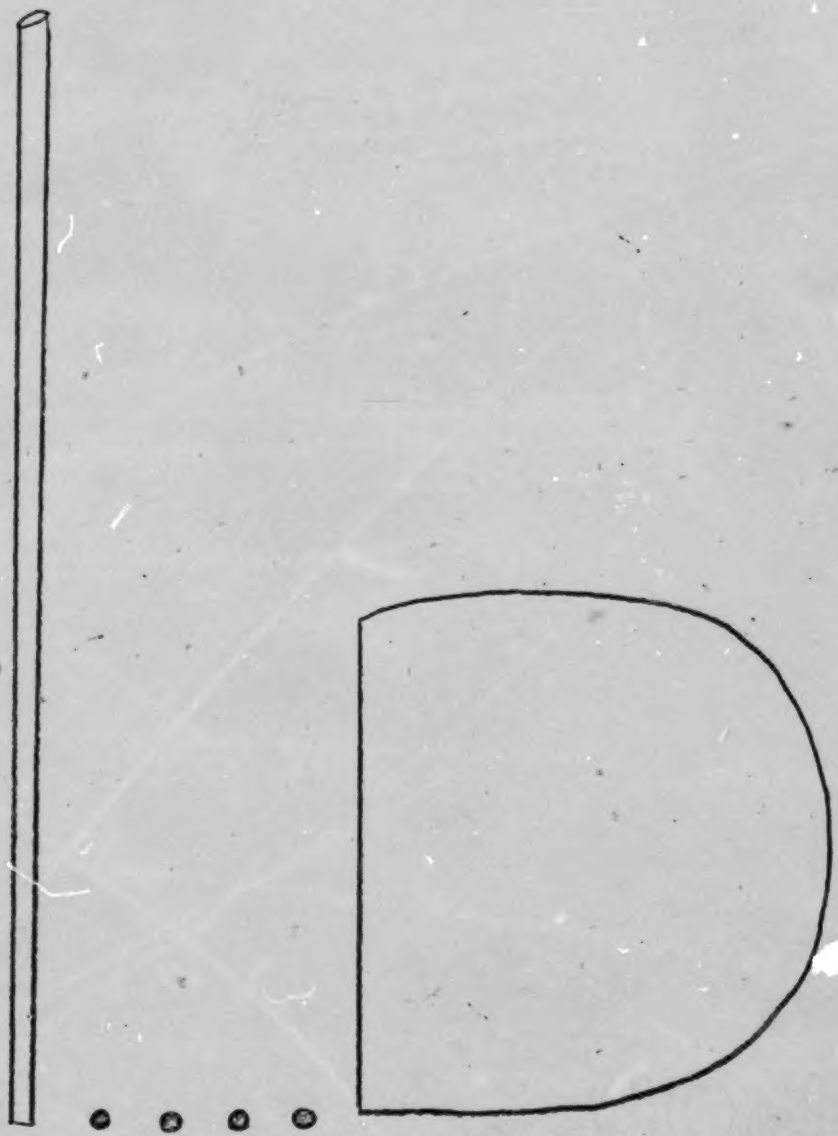


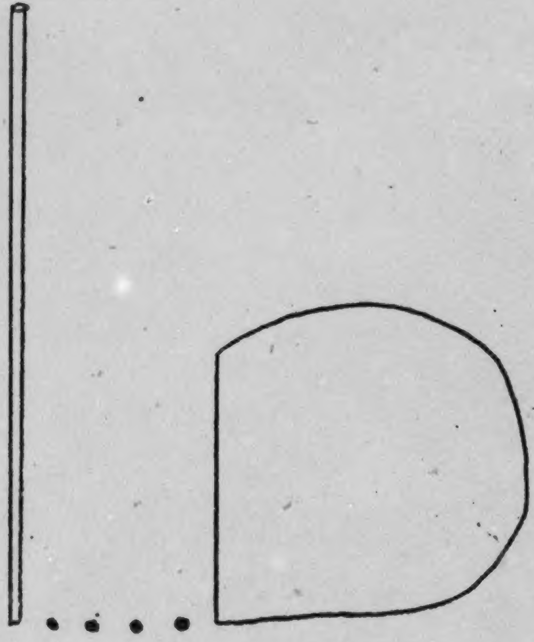


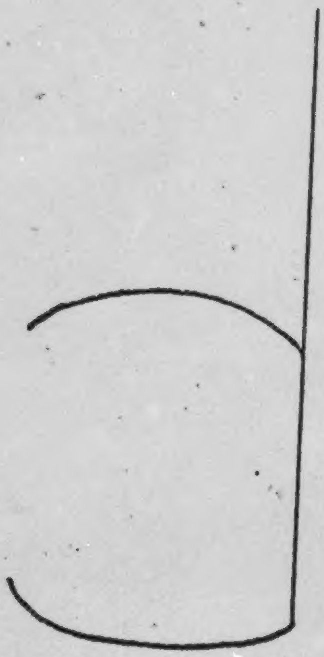


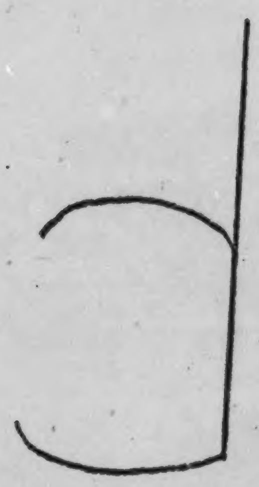


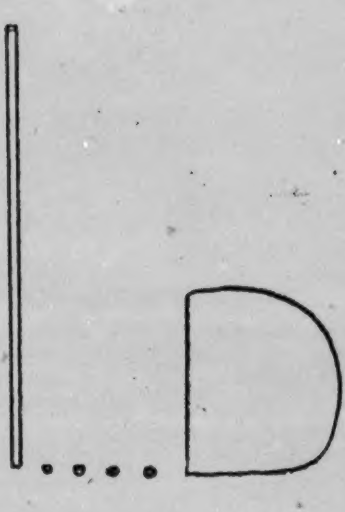


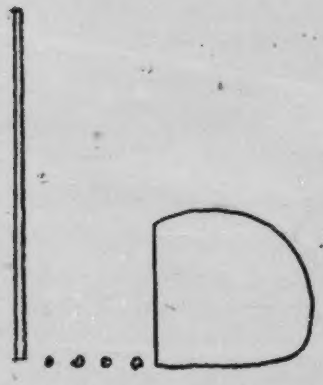


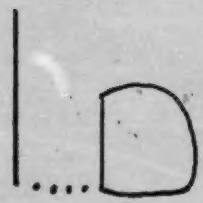


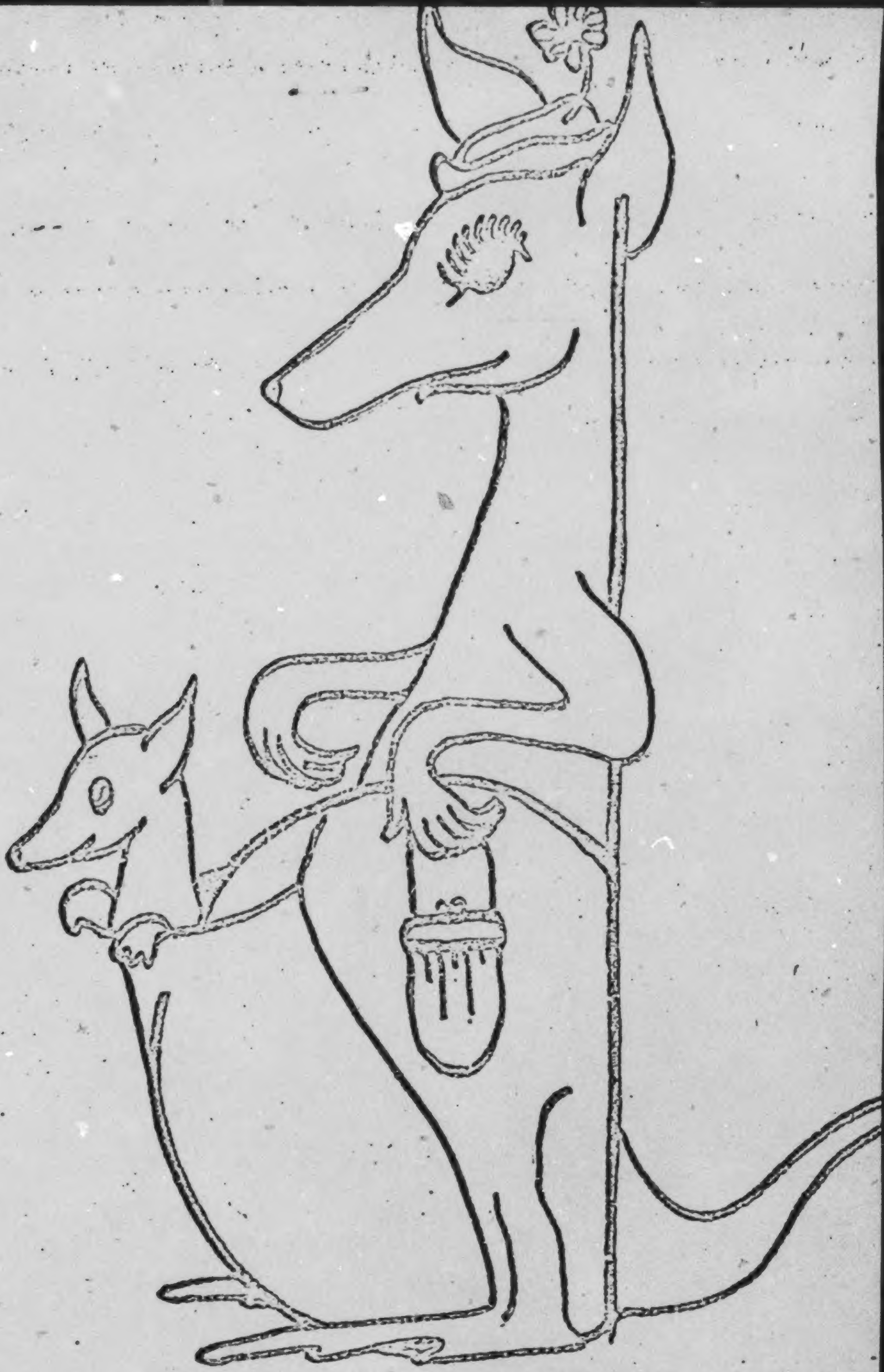


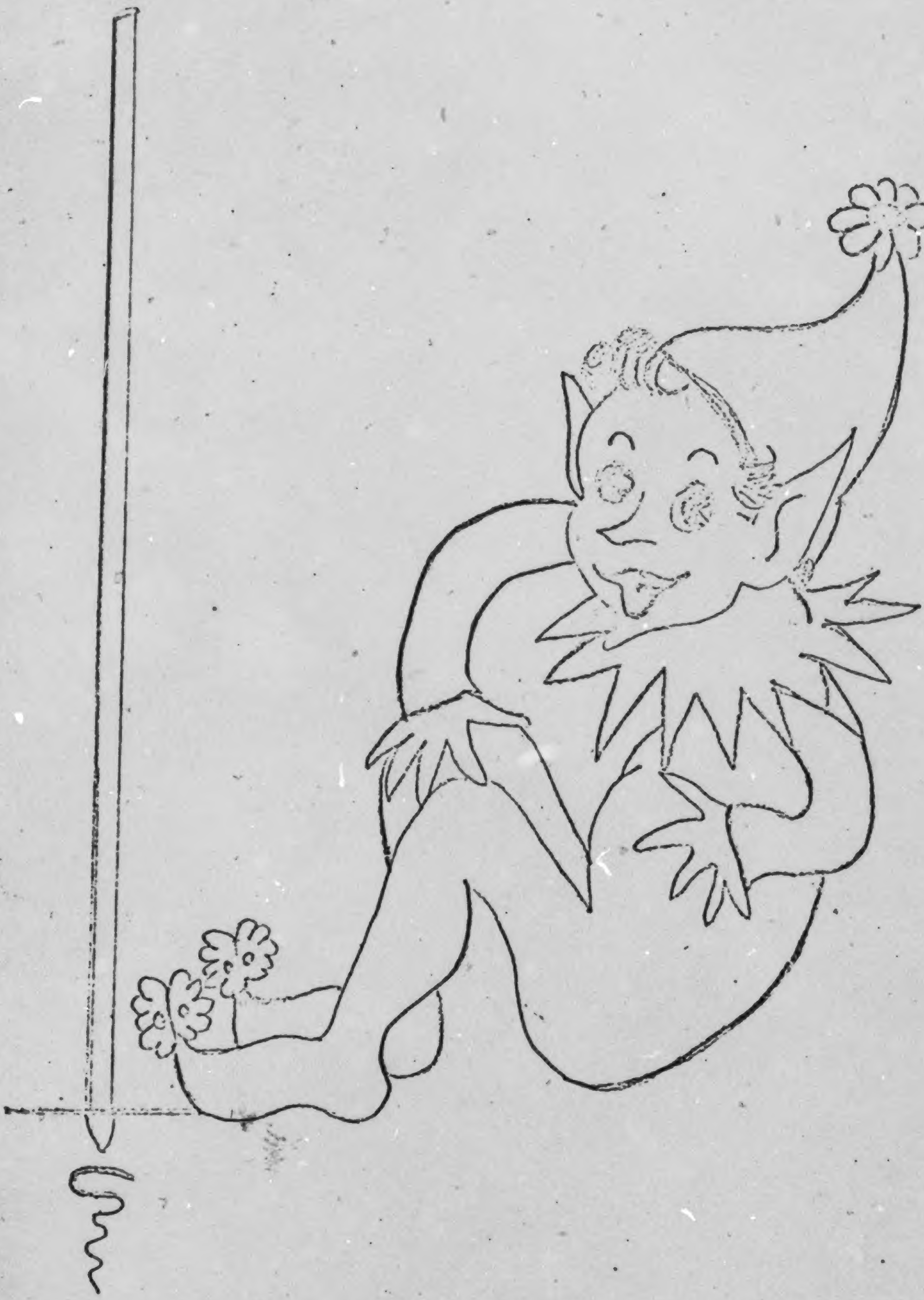




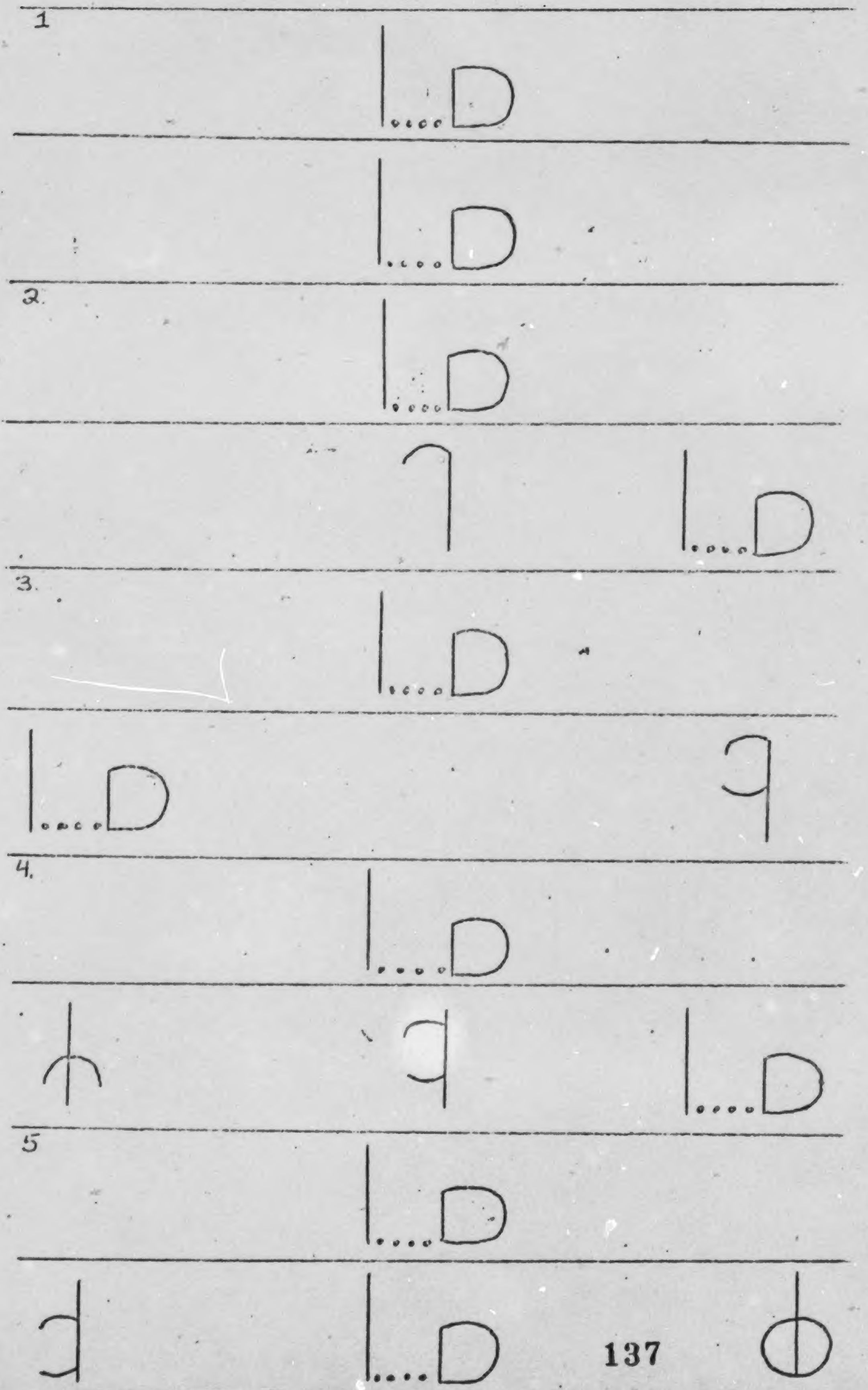




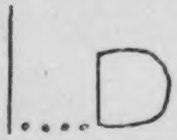


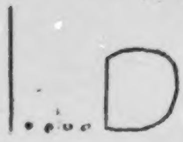


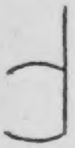
b- Program

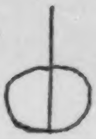


6

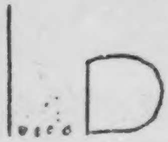


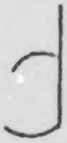


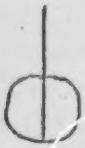


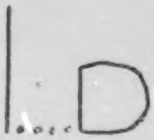


7

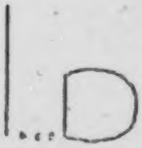


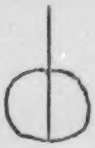


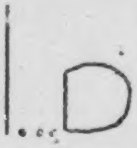


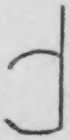


8

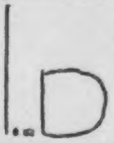


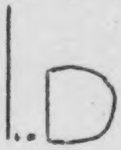


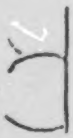


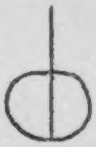


9

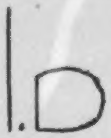


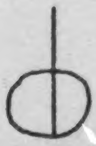


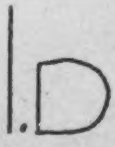


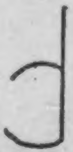


10

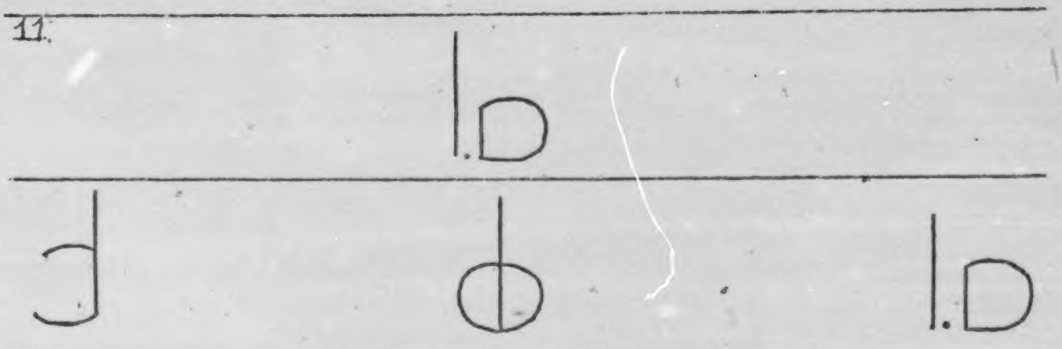




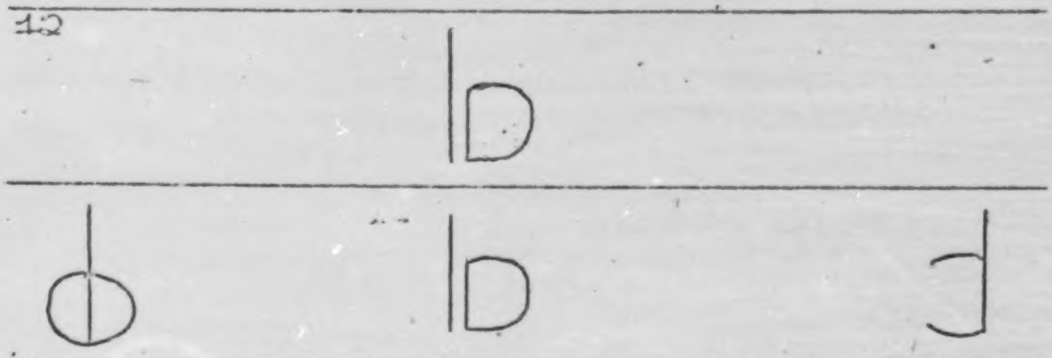




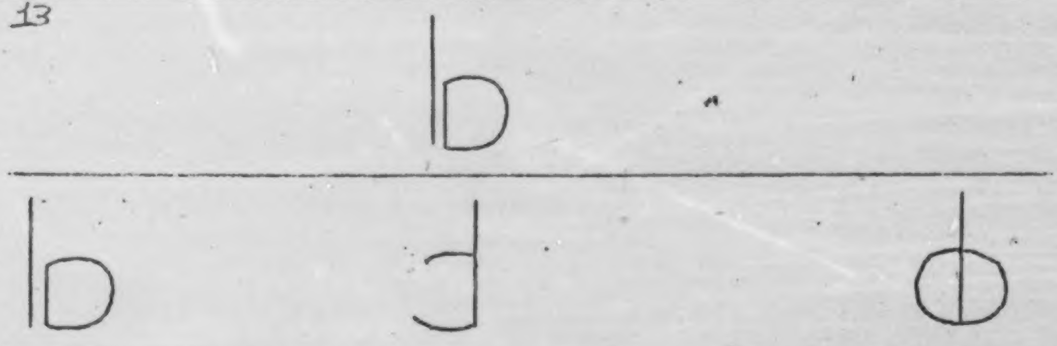
11.



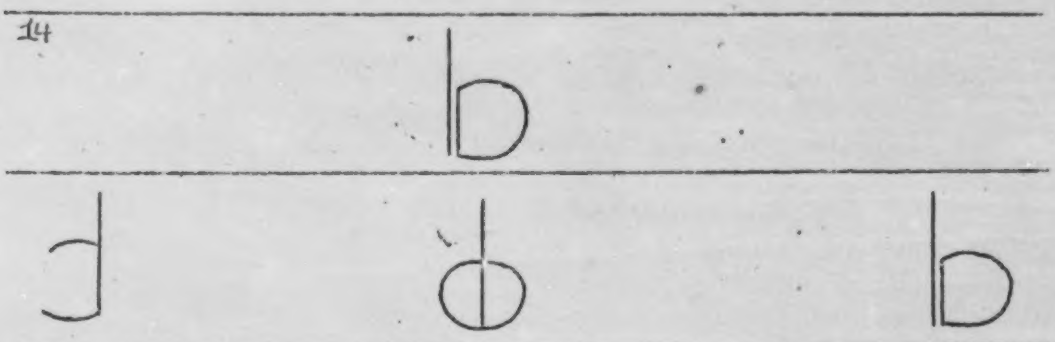
12



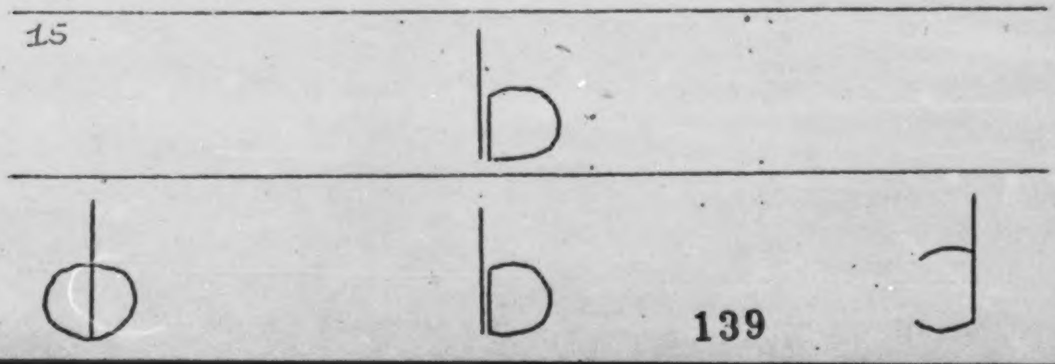
13



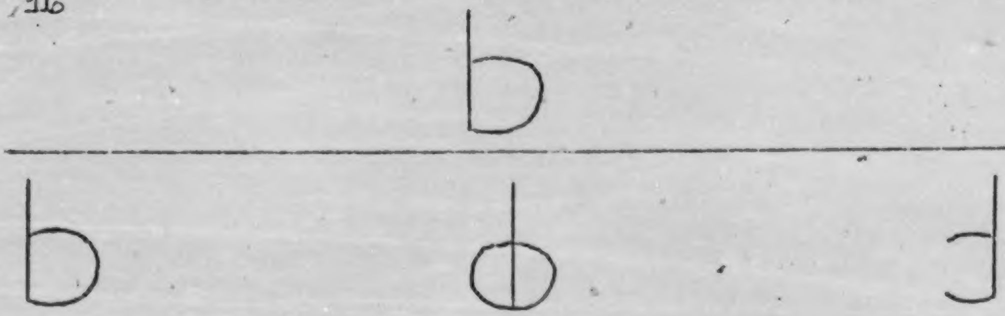
14



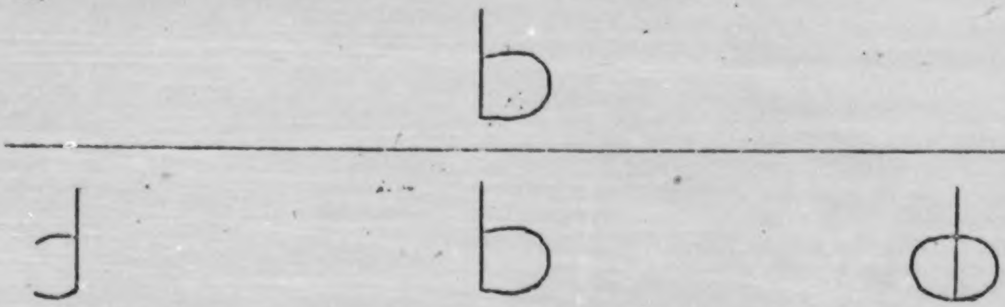
15



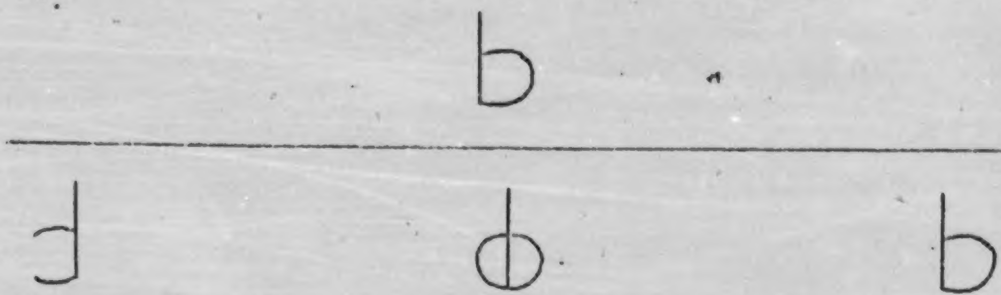
16



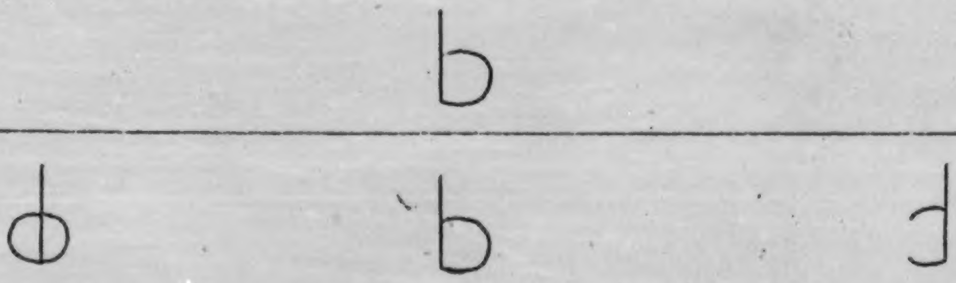
17



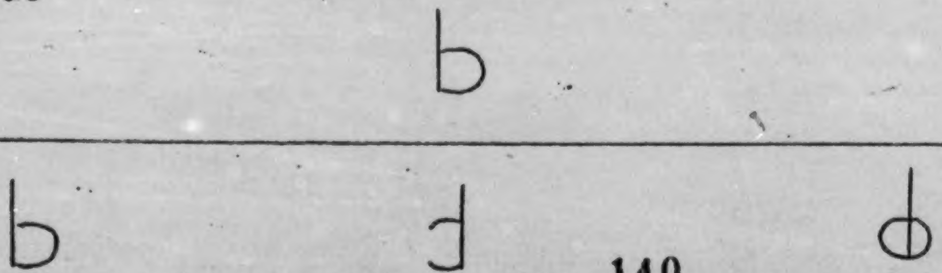
18

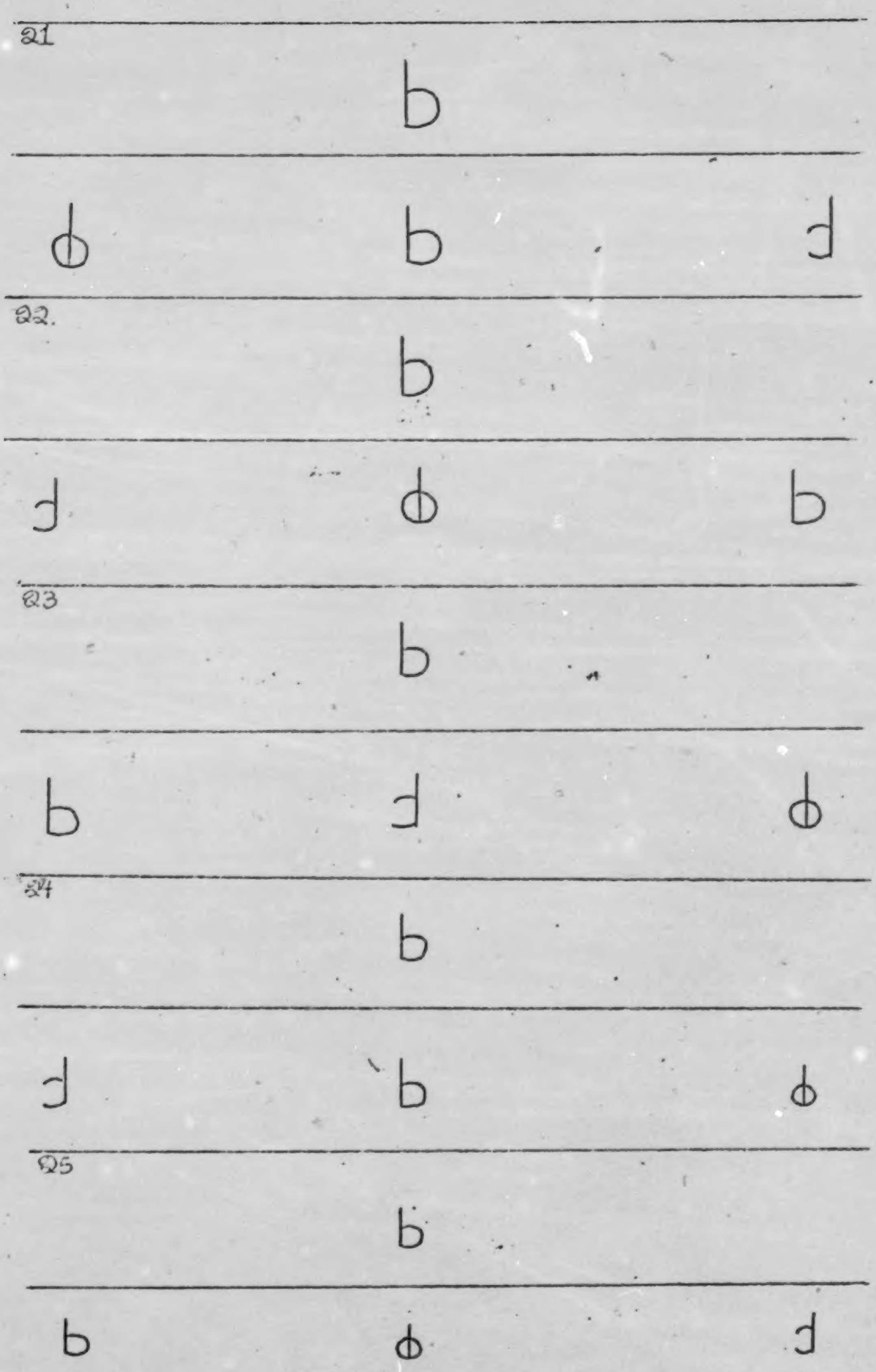


19



20.




21
22.
23
24
25

26

b

ɸ d b

27

b

d b ɸ

28

b

ɸ d b

29

b

b ɸ d

30

b

d ɸ b

31

b

b ɸ d

32

b

d ɸ b ✓

33

b

b ɸ d

34

b

d b ɸ

35

b

ɸ b d

36

b

b d ɸ

37

b

d ɸ b

38

b

b ɸ d

39

b

ɸ b d

40

b

b d ɸ

41

b

φ b d

42.

b

φ d b

43

b | b φ d

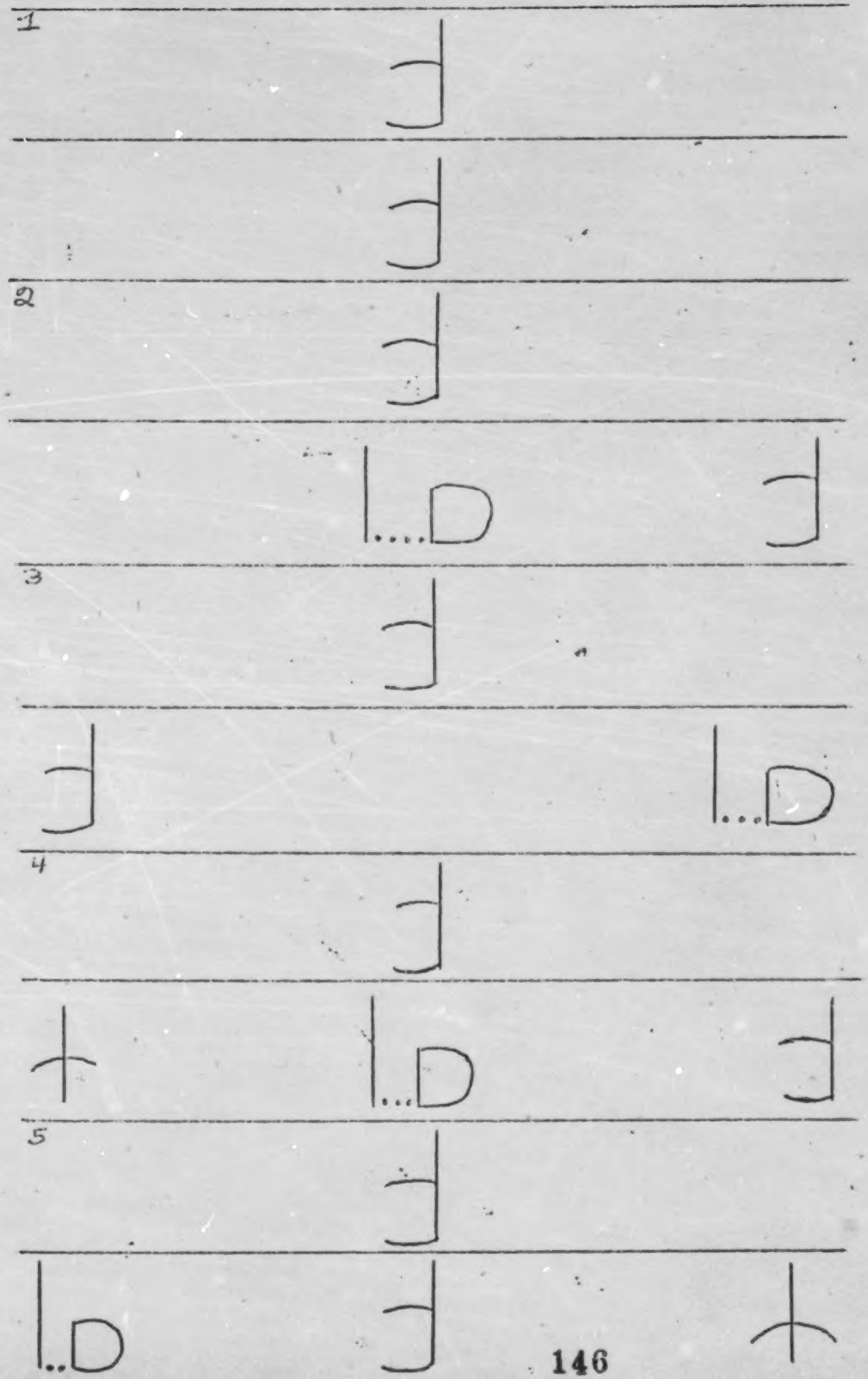
44

b | φ d b

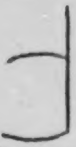
45

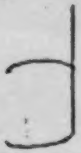
b | b d φ

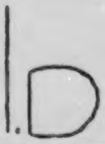
d- Program

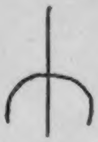


6

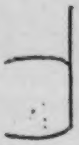


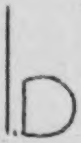


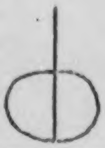


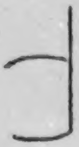


7

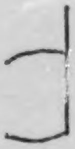


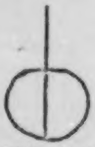


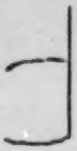


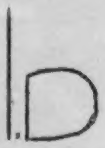


8

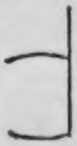


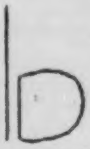


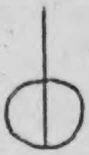


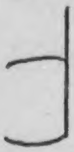


9

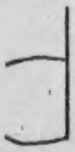


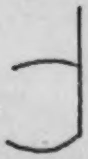


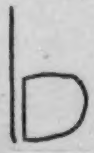


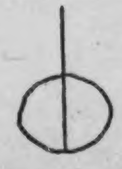


10

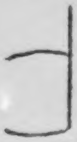


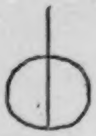


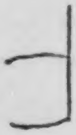


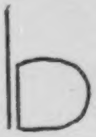


11.

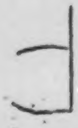


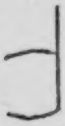


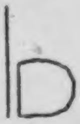


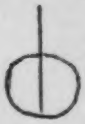


12.

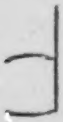


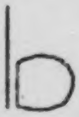


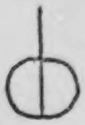


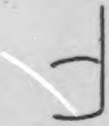


13.

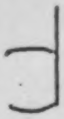


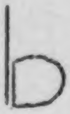


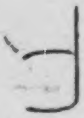


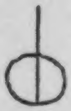


14

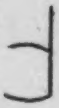


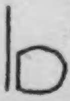


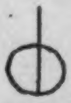


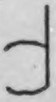


16.

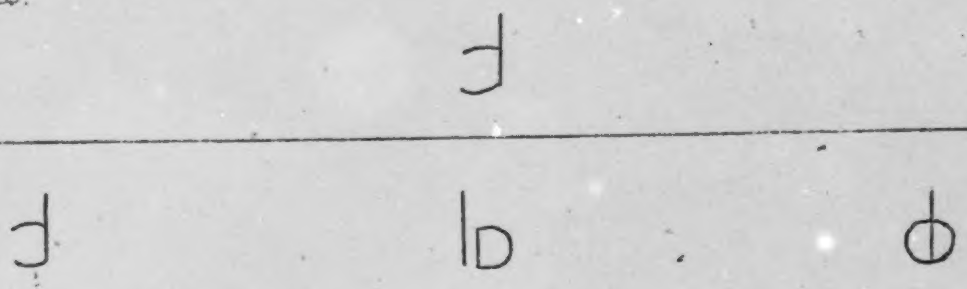




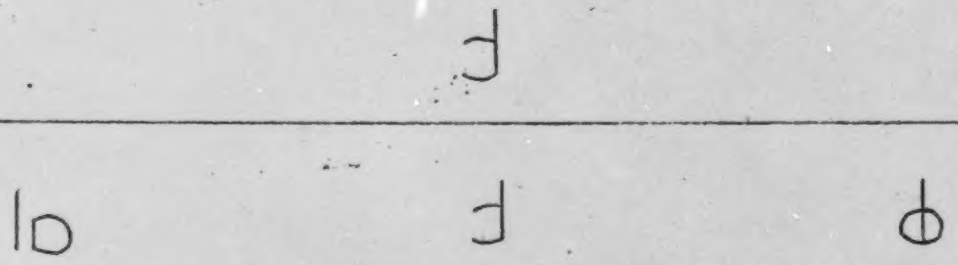




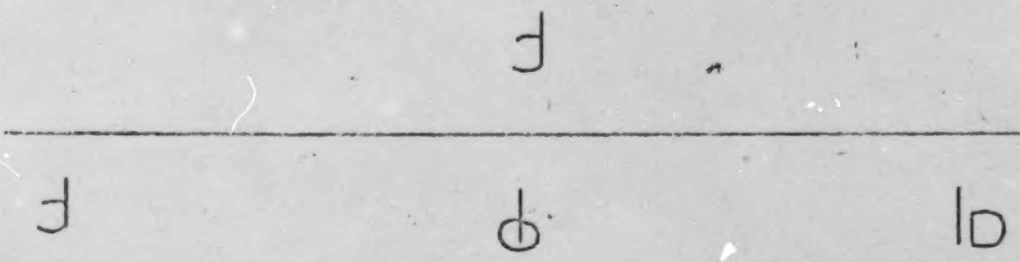
16.



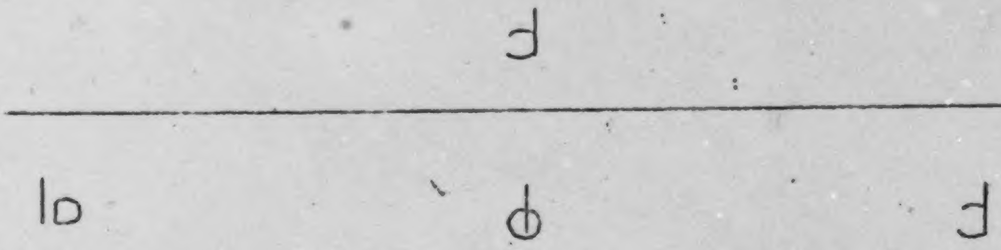
17



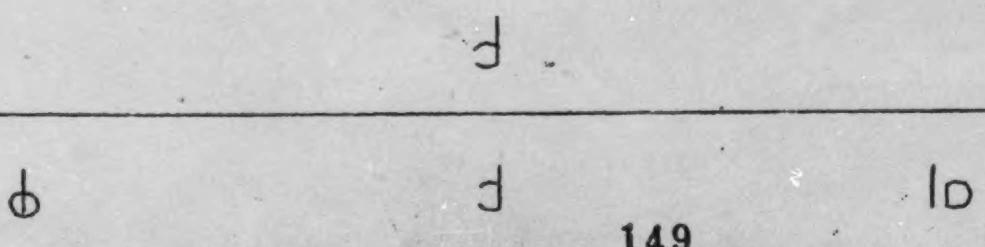
18



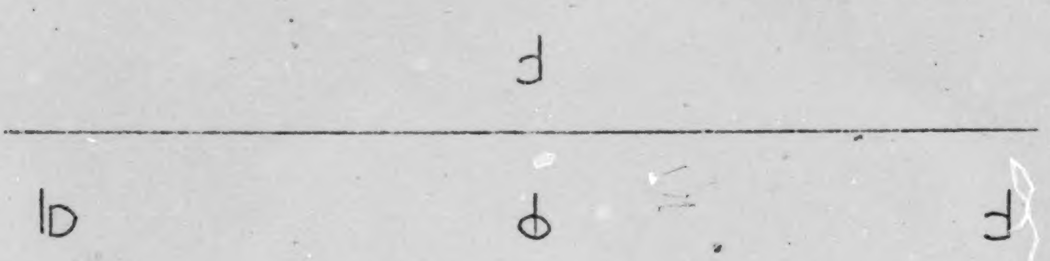
19



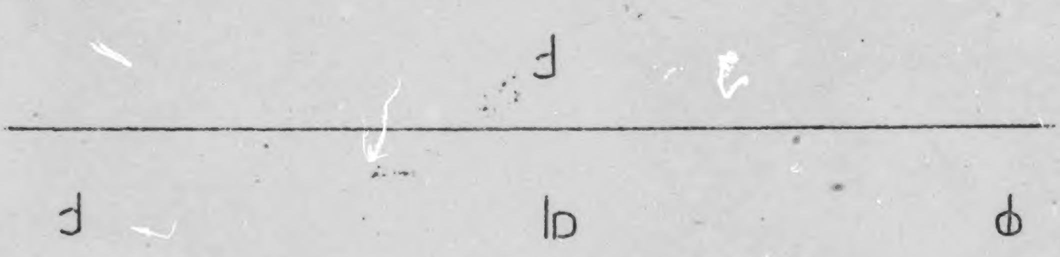
20



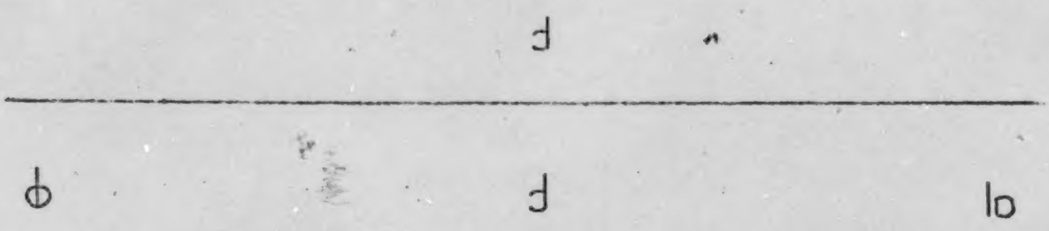
21



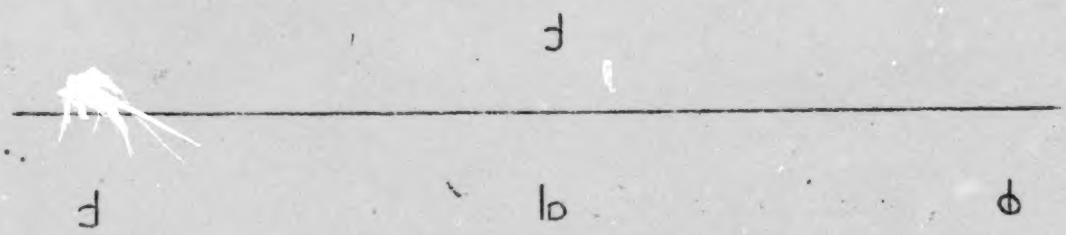
22



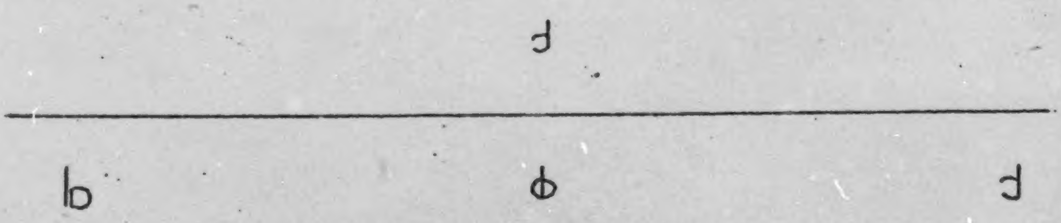
23



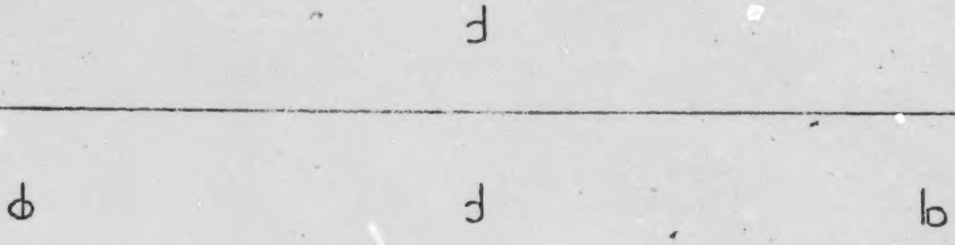
24



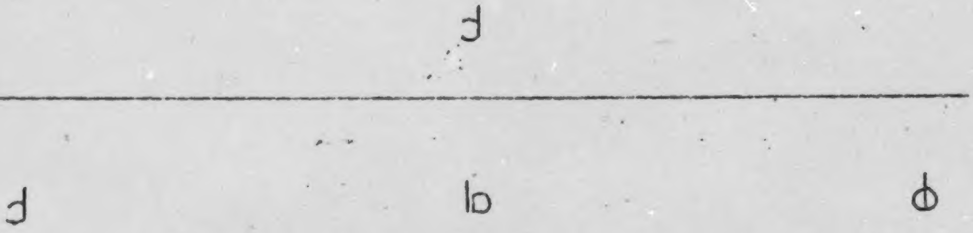
25



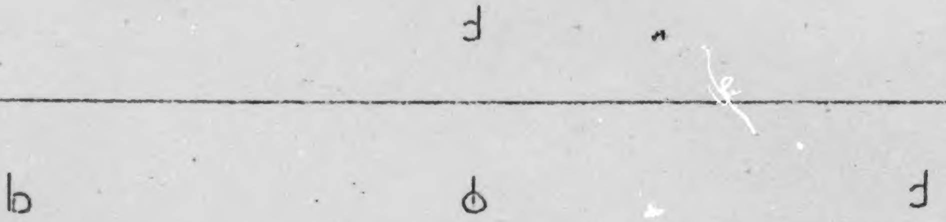
26



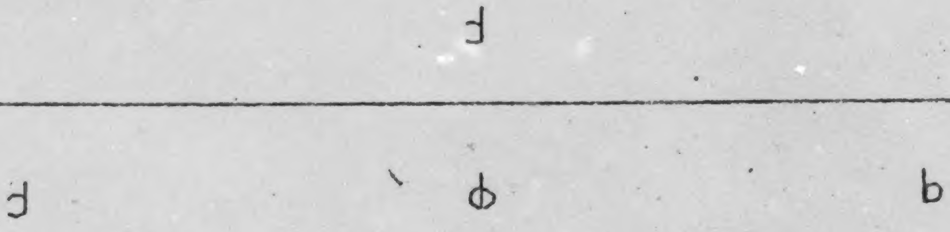
27



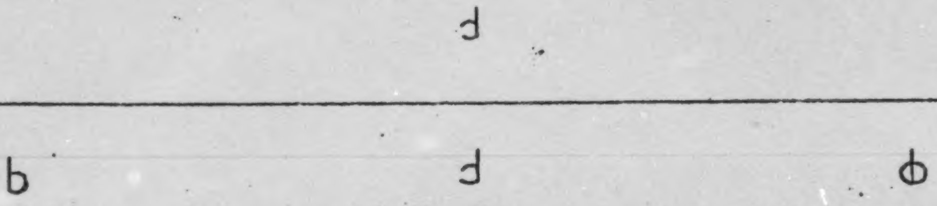
28.



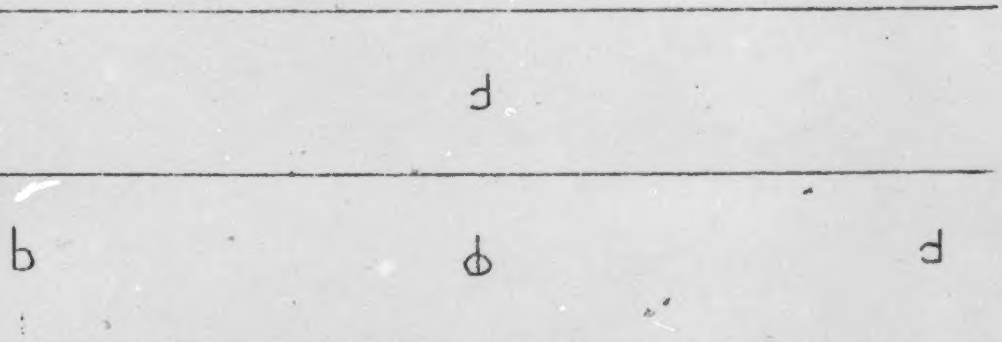
29



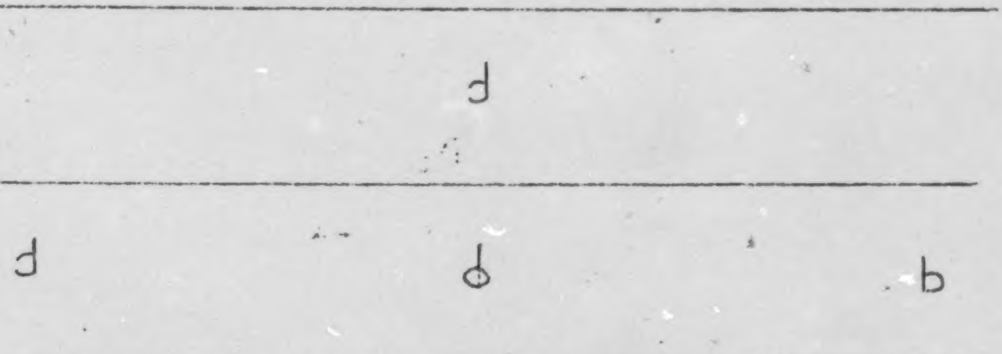
30



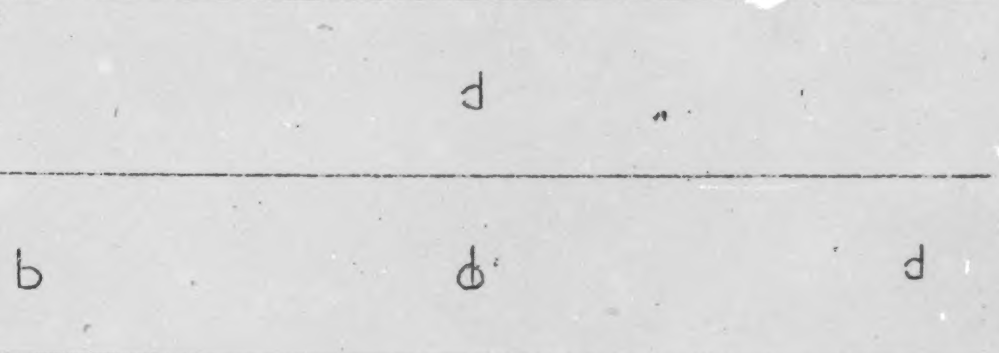
31



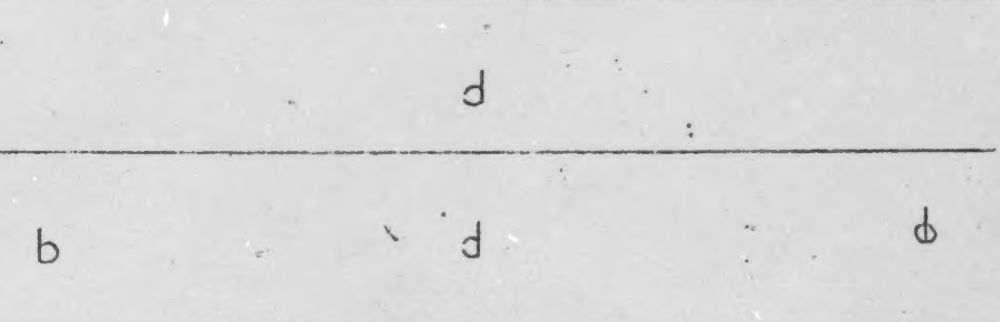
32



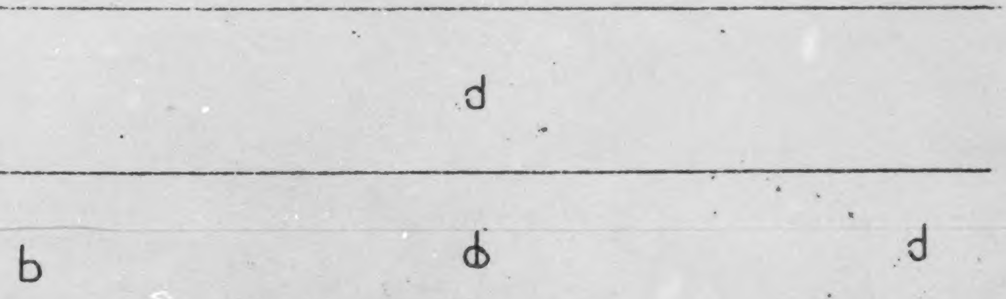
33



34



35



36

d

d ɸ b

37

d

ɸ d b

38

d

b ɸ d

39

d

ɸ d b

40

d

d b ɸ

41

d

ɸ d b

42

d

ɸ b d

43

d | d ɸ b

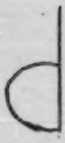
44

d | ɸ d b

45

d | d b ɸ

b-Combination

1	b	b	ɸ	d
2	b	ɸ	d	b
3	b	ɸ	b	d
4	b	b	ɸ	d
5		ɸ	d	b

b

6	d	d	ɸ	b
7	d	ɸ	b	d
8	d	ɸ	d	b
9	b	ɸ	d	b
10	b	d	b	ɸ

b

11	b	ȸ	d	b
12	d	d	ȸ	b
13	d	ȸ	b	d
14	d	d	ȸ	b
15	b	ȸ	b	d

b

16	b	b	ɸ	d
17	d	ɸ	d	b
18	d	ɸ	b	d
19	b	d	b	ɸ
20	b	b	ɸ	d

b

21	b	ɸ	d	b
22	d	d	ɸ	b
23	d	ɸ	b	d
24	d	ɸ	d	b
25	b	b	ɸ	d

b

26	d	ȸ	b	d
27	b	ȸ	b	d
28	b	d	ȸ	b
29	d	d	b	ȸ
30	d	ȸ	d	b

b

31 b	b	d	ɸ
32 b	ɸ	b	d
33 d	ɸ	b	d
34 b	ɸ	d	b
35 d	d	b	ɸ

b

36	d	ɸ	d	b
37	b	b	ɸ	d
38	d	ɸ	d	b
39	d	ɸ	b	d
40	b	d	b	ɸ

b			
41. d	d	ȸ	b
42. b	ȸ	d	b
43. d	b	d	ȸ
44. d	ȸ	b	d
45. b	b	ȸ	d

Recall of verbal label

Order of occurrence and size of type

1. d
2. b
3. b
4. d
5. b
6. d
7. d
8. b
9. d
10. b

THREE DIMENSIONAL PROGRAMMING OF SIMPLE AND COMPLEX RELATIONAL ABSTRACTIONS[1]

by

Barbara C. Etzel and Wallace B. Dial

KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Final Progress Report

December, 1972

Distribution or quotation of
any portion of this paper
must be with the permission
of the Authors.

Program 2
Component D
Project 3BOK05-3

THREE DIMENSIONAL PROGRAMMING OF SIMPLE AND COMPLEX RELATIONAL ABSTRACTIONS[1]

by

Wallace B. Dial
B.S., Kansas State College of Pittsburg, Kansas, 1957

Submitted to the Department of Human
Development and the Faculty of the
University of Kansas in partial fulfillment of the requirements for the
degree of Master of Arts.

Instructor in Charge

Frances Degen Horowitz
For the Department

ACKNOWLEDGEMENTS

The author is deeply indebted to the members of his committee, Dr. Barbara C. Etzel, Dr. Judith M. LeBlanc and Dr. Donald Green for patient and wise counseling to theoretical and procedural questions related to this study. Specific appreciation is due Dr. Etzel for her tolerance, interest, enthusiasm and counsel over the span of this study.

To his friend, Duane A. Newman, the author owes a great debt for hours of graph and apparatus construction.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS i

LIST OF TABLES ii

LIST OF FIGURES. iii

INTRODUCTION 1

METHOD 3

    Subjects 3
    Apparatus and Experimental Setting 3
    Procedures 4
    Machine Training 5

EXPERIMENT I 5

    Pretest. 5
    Training 6
    Design 7

RESULTS. 7

    Descriptive Data on Simple Relational Abstractions 7
    Experimental Training Data on Simple Relational Abstractions. 10

DISCUSSION 19

EXPERIMENT II. 22

    Subjects 22
    Pretest. 22
    Training 22
    Design 23

RESULTS. 25

    Discriptive Data on Complex Relational Abstractions 25
    Experimental Training Data on Complex Relational Abstractions. 27

DISCUSSION 33

REFERENCES 35
FOOTNOTES. 36
TABLES 37
FIGURES. 43
APPENDIX 68

LIST OF TABLES

Table

I Summary of experimental history (type of program, type of cue, program or control sequence) for each subject who did not meet criterion behavior on simple relational pretest.

II Summary of experimental history (type of program, type of cue, program or control sequence) for each subject who did not meet criterion behavior on complex relational pretest.

LIST OF FIGURES

Fig. 1: Percent correct on four simple relational pretests for subjects-to-be-programmed, for subjects who learned and for subjects who had zero errors. The range averages and means for the three groups are given in the boxes. The bars are of individual percentages.

Fig. 2: Individual percent correct of simple relational concepts across four pretests by groups, subjects-to-be-programmed and subjects who learned through pretests.

Fig. 3: Percent correct and individual comparison across subjects-to-be-programmed and subjects who learned on first four pretests and additional pretests of simple relational concepts.

Fig. 4: Simple relational concepts percent correct across extended pretest for Subjects B and C.

Fig. 5: Relational concept position percent correct across four pretests for subjects-to-be-programmed and subjects who learned during pretests.

Fig. 6: Subjects A and H percent correct on pre and posttest and intervening program (no fading, all responses cued).

Fig. 7: Percent correct on pre and posttest and intervening programs in which three-step fading was used for Subjects I and H.

Fig. 8: Percent correct on pre and posttest and intervening program (front) in which seven-step fading was used for Subject I.

Fig. 9: Percent correct on pre and posttest for Subjects B, D, E and G having intervening verbal instructions.

Fig. 10: Comparison of programmed and nonprogrammed (control) sequences for Subject H (Front-Back/Behind) programs.

Fig. 11: Comparison of three-step fading program and nonprogrammed (control) sequences for Subject I.

Fig. 12: Percent correct on two complex relational pretests (four sequences) for subjects-to-be-programmed, for subjects who learned and for subjects who had zero errors. The range average means for the three groups are given in the boxes. The bars are of individual percentages.

Fig. 13: Individual percent correct of complex relational concepts across two pretests (four sequences) by groups, subjects-to-be-programmed and subjects who learned through pretests.

Fig. 14: Percent correct on first two pretests and additional pretests for individual subjects on complex relational concepts.

Fig. 15: Percent correct on additional complex pretests for subjects who learned on first two pretests.

Fig. 16: Percent correct across two pretests (four sequences) for subjects-to-be-programmed and subjects who learned during pretests.

Fig. 17: Comparison of programmed and nonprogrammed (control) sequences for Subject O (Top Right Back) program.

Fig. 18: Percent correct on pre-posttest and intervening programs (Right Front/Center Front, Top Right Back/Top Left Back) for Subject J.

Fig. 19: Comparison of programmed (Left Side/Right Side - Left Front/Right Front) and nonprogrammed (control) sequences for Subject L.

Fig. 20: Comparison of programmed (Left Side/Right Side) and nonprogrammed (control) sequences for Subject I.

Fig. 21: Comparison of programmed (Top Left/Top Right) and nonprogrammed (control) sequences for Subject H.

Fig. 22: Comparison of programmed (Left Side/Right Side) and nonprogrammed (control) sequences for Subject A.

Fig. 23: Percent correct on pre-posttest and intervening program (Left Front/Right Front) for Subject M.

Fig. 24: Percent of increase or decrease of correct responses from pretests to posttests on nonprogrammed stimuli for experimental and control subjects.

Fig. 25: Total experimental history (nine complex relational positions across four tests with intervening programs) for Subject J.

INTRODUCTION

One of the basic preacademic skills that most preschool children acquire before starting their formal education is appropriate responding to directions that contain spatial relational concepts. One source of normative data (Castner, 1940) collected on two through four year olds indicated that instructions which contained "on," "in," "behind" or "in back of," "in front of," "under" and "beside" resulted in increasingly successful responding across this age range. Two year olds did not exhibit behavior that would indicate a consistent discrimination between these words. By four years of age most of the children are successful with at least four of these relational concepts.

Most of the developmental literature further suggests that these simple relational concepts (in, on, front, etc.) are acquired earlier than those that contain some aspect of a left-right orientation. For example, "side" or "beside" would be a functional term for a three or four year old preschool child, while "left side" may not necessarily be responded to in a consistent manner. For example, Boone (1965), noted a time differential between the acquisition of such concepts as "front" or "behind" and those with a left-right orientation.

The importance of a child acquiring these concepts has been consistently pointed out by those concerned with planning preschool curriculums. Teachers note that much of the child's future learning is based on, and in fact uses the acquisition of relational concepts in order for other responses and skills to be learned.

Engle (1964) noted that a relational concept was one that did not shape a fixed characteristic (as do other concepts) but instead shares fixed relationships. For example "hardness" is a fixed physical characteristic which is found in many materials. However, to "explain," "in front of," requires a common spatial orientation of one object to another.

Hilgard (1962) described concepts in terms of common or shared qualities in otherwise diverse objects, situations or events. Using both Engle's and Hilgard's definitions of "relational" and "concept," it is possible to define simple and complex relational abstractions as used in the present study. However, for the purposes of this research, the term "abstraction" instead of "concept" will be used since this places the "common characteristics" in the environment rather than in the "mind" of the subject.

Relational abstractions refer to specific stimuli (for example, "left side" and "top left back") that are acquired because of a common spatial orientation of the particular positions to an object (a house). Simple abstractions refer to a single orientation of one object to another; while a complex abstraction refers to two or more common spatial orientations.

The purpose of the present study was twofold. The first was to collect descriptive test data on a group of preschool children with respect to their consistency in following directions which used both simple and complex relational terms. The second purpose was to devise procedures that would help preschool children acquire these behaviors if they were not observed. Since the past normative and descriptive data indicated that following directions which include complex relational abstractions are usually not a part of the preschool child's repertoire then errorless (programming) procedures were used in the training programs. Terrace (1963a, 1963b) described several procedures that resulted in an infahuman organism's rapid and near errorless acquisition of a visual discrimination. These procedures which included the fading of lights were incorporated in the present study in an attempt to see if preschool children could learn the more difficult relational discriminations.

METHOD

Subjects

The subjects were 19 children from the Edna A. Hill Child Development Preschool Laboratories at the University of Kansas. Their ages ranged from three years one month to four years eight months with a mean age of three years ten and one half months. The children were not selected for the study on any basis other than the fact that they were available as experimental subjects at the time the study was to be run. However, the 19 children were a fairly heterogeneous group (drawn from four preschool classes) with respect to socioeconomic income, race, and skills demonstrated in each of their classes.

Apparatus and Experimental Setting

The experimental room was a well lighted and ventilated sound resistant room measuring six feet wide and fifteen feet long. The subject stood on a "happy face" board that had been placed on the floor prior to the session, approximately seven feet from the response apparatus, the "magic house." Each response key of the "magic house" was a two by three inch plastic rectangle. An orange foam rubber pad, circular in shape, was the response target. This target area was mounted in the middle of the response key. Behind the key was a microswitch (normally open), that, when activated by the subject pressing the pad on the response key, resulted in a signal to the electromechanical relay rack.

The subject was given a "magic wand" to push the response keys. The "magic wand" was constructed from an eleven inch long, three-eighths dowel rod glued into a rubber ball. The "magic house" was twelve inches wide, twelve inches deep and fifteen inches tall. There were three response areas in the "front"; right front, center front, and left front. In addition there was one response area "under" the house; one in back for both "back" and "behind"; one for each "side"; right side and left side; and four on "top" for top right front, top right back, top left front, and top left back. (Also "top right," "top left"). This allowed seventeen responses of varying difficulty (due to combinations of relational terms) to be tested.

Each position was wired in conjunction with an electromechanical relay rack which recorded: correct responses; incorrect responses; and total correct responses (by means of four banks of digital counters and a twenty pen Esterline Angus event recorder). The event recorder was programmed to record intratrial responses as well as correct and incorrect response positions. When the subject pressed the correct key a chime sounded from within the house and a marble was simultaneously delivered from a marble dispenser resembling a clown. The clown had a nose (red bulb) that illuminated with each correct response. This marble dispenser was located approximately two feet from the "magic house." Reinforcement could be either automatic or manually controlled for correct response.

Programming cues attached to the house were red lights located one-half inch above each response target area. Any one or all of the lights could be dimmed from full brightness on a continuous scale to fully out. They could be flashed at various rates or held at a constant intensity, or turned on or off for any sequence. Another programming cue was a buzzer that could be turned up or down on a continuous scale of volume and could be physically placed by hooks at any of the response target areas. The onset and offset of the buzzer was controlled by the experimenter.

Procedures

The experimenter acquainted each subject with the experimental room and the reinforcement delivery system. The subject was then shown a box with a number of toys and told to choose one that he liked. The toy was then placed over a hole that was marked by an orange circle. The subject was then told if he got enough marbles to fill all of the holes up to and in the orange circle he would get the toy.

Machine Training

A machine training session was first given to each subject. A red light was on over the correct response target area and the subject was instructed to "find the red light that is on and push the ball under it." The machine training session consisted of nine responses designed to acquaint the subject with each response area. At no time was the name of a position used during this initial machine training session.

EXPERIMENT I

Assessment and Training of Simple Relational Abstractions

Pretest

Following machine training subjects were then given four days of simple pretests. Each pretest day tested six positions (front, under, behind, top, side, and back). This simple pretest was made up of twelve trials which meant that each position was tested twice. All six positions occurred during the first half of the pretest and were followed by a different sequence of the same six positions in the second half. A copy of the simple pretest data sheet is found in the Appendix.

The four days of pretests were given without the use of any light or buzzer to cue the position. However, if the subject was correct, the house would ring its chime and the clown's nose would light up as a marble was delivered. The subject was instructed that the experimenter would tell him where to put the "magic wand" and that if he was correct the house would ring its bell and the clown would give him a marble. The subject's data was then analyzed after these four simple pretests to see if and what type of training program was needed. Some subjects initially served as controls to investigate the effects of trial and error learning in comparison to programming.

Training

There were three general types of training procedures used. 1.) In the no fading all-positions-cued group, the subjects had a red light over each position to which they were instructed to respond. The light was on regardless of whether the child had errors or not to that position during the pretests. The second day of the training program was the same as the first except no lights were on during the sequence. Therefore no fading of lights was involved with this procedure. 2.) In the group that had fading with one-or-two-positions-cued, the subjects had a red light or buzzer over a position which the pretests had indicated was not successfully responded to. Other positions used in the training sequence were usually those to which the subject had successfully responded to on the pretests. The programmed cue for any response that was being trained was first presented verbally and in unison with the red light and/or buzzer. These light or buzzer cues were located above the positions being trained and were faded out in intensity anywhere from one to seven steps. Since there were lights located next to each response key there was no need to remove the light apparatus (e.g., socket, etc.) after they were faded to total darkness. When the buzzer was used it had to be physically removed when its sound was completely faded out, since it was added to only one location for programming purposes. Units of fading (of lights and buzzer) were accomplished by the use of a calibrated potentiometer.[2] 3.) The third group was trained primarily by verbal instructions. This group was made up of children who had only one consistent positional error. Then when they made an error to this position the experimenter told the child the correct position, pointed to it, and had the child respond. Thereafter no further instructions were given and the effects were then measured by data from subsequent trials and sessions.

Individual procedures for each subject within each of these three training conditions will be noted during the analysis of their data.

Design

The descriptive datum on the 19 subjects was collected by repeated pretests (4) and analyzed for evidence of acquisition curves. Additional pretests were also given to subjects to see if learning would occur with extended trial and error experience. As a result of the pretest data subjects were grouped into those that: 1. had zero errors across all pretests; 2. met a criterion of 100% correct on two successive pretests after initial errors; and 3. those that should have training since acquisition to a 100% criterion on all positions did not seem to be possible with repeated pretests.

The training design was then a simple pretest-training-posttest design. However, additional controls were possible by replicating the training procedures across subjects and through the use of control subjects. The control subjects received the same sequence, number of trials, sessions, and instructions, but they did not receive the light and/or buzzer cues or the fading procedures. Table I summarizes the experimental history for each subject that did not meet criterion behavior on the simple relational pretests.

Insert Table I About Here

RESULTS

Descriptive Data on Simple Relational Abstractions

Of the 19 subjects, identified by letters from A through S (Fig. 1), almost half (47%) were placed in the to-be-programmed group since they did not

----

Insert Fig. 1 About Here

----

meet the criterion of 100% correct responses on their last two pretests. This group (Subjects A through I) had an average of 79% correct responses to the simple relational positions of front, under, behind, top, side, and back, while their individual percentages ranged from 67 to 90%.

Subjects J through M (21% of the total group) met the criterion of 100% correct responding on two successive pretests. These subjects had errors initially on their tests and therefore averaged 93% on all four tests with individual percentages ranging from 88 to 98%. Only one subject in the to-be-programmed group (H) made a higher percentage correct across the four pretests than Subject J in the "learned" group whose percentage was 88. Otherwise the two groups did not overlap.

Six subjects (N through S) made no errors during the pretests and made up 32% of the total group. As a result, approximately half (53%) of the 19 children in this study either consistently responded correctly or with little instruction (trial and error responding with feedback for correctness only) acquired these simple relational abstractions.

Fig. 2 shows the percent correct of each of the four pretests for individual subjects in the to-be-programmed and learned groups. The nine subjects who were trained by some procedure (top three rows of graphs) did not tend to show the same "stair-step" increase across pretests as did the subjects who learned.

Insert Fig. 2 About Here

Additional pretests (Fig. 3) were given to Subjects B, C, and F from the to-be-programmed group and J and M from the learned group. There was a

Insert Fig. 3 About Here

slight increase in the percent correct on the additional pretests for Subjects B, C, and F (who had 7, 12, and 2 additional tests respectively).

Fig. 4 shows the data on two of these subjects (B and C) for the behind

----

Insert Fig. 4 About Here

----

position (dotted line) and all other positions (solid line). The data indicate that these two subjects started to respond correctly (and consistently) to "other" positions during the first four pretests, but never "learned" behind in either 11 or 16 sessions. In contrast Subjects J and M (Fig. 3), with one additional pretest, met the criterion of two successive pretests of 100% correct responding on each with only one additional pretest.

In Fig. 5 the data are plotted by each simple relational position on

----

Insert Fig. 5 About Here

----

each of the four pretests. The dotted lines represent the data for the subjects who learned and the solid curve the subjects to-be-programmed. By comparing the curves of these two groups, it appeared that the positions "under" and "top" were responded to equally successfully. Both groups were above 90% on all tests. The other four positions (front, behind, side and back) were consistently responded to with a higher percent of correct responses by the subjects who learned. The one position with the greatest discrepancy between the two groups was "behind." It is doubtful that the to-be-programmed subjects did not tend to respond to this area because it was not in view when the subjects received their directions facing the front of the house. This could be concluded since the "back" position (same location as behind) was responded to with the most correct responses of these other four positions by the to-be-programmed group.

Experimental Training Data on Simple Relational Abstractions

Two subjects (A and H) were run on training programs which had no fading of cues during the sessions, but who did have all positions cued regardless of the pretest success or error data. Table I indicates that this program sequence for A contained six "front" trials randomly intermixed with nine trials of the other five positions. The program sequence was run on two days. All positions were cued with a red light over the response area on the first day and with no light on the second day. Fig. 6 (top graph) shows the pre and posttest percent correct for each position (bars) and the percentage of correct responses during the two days of the program sequence (the RC row of figures below the ordinate).

Insert Fig. 6 About Here

During the pretests (solid bars) Subject A made errors to front (75%), back (50%), and side (25%). The program sequence contained more trials to front since the pretest data indicated that A was only 25% correct to this position. The posttest (dotted bars) data collected over two sessions (24 trials) indicated that A responded 100% correctly to all relational positions.

Subject H had a similar two-day sequence of no fading with all responses cued. Since H only had errors (63%) to behind on the first four pretests, that position had more trials (12) per session than the other positions (four per session). The program sequence resulted in 100% correct responding across both days, and Subject H had no errors to the behind position on the posttest. However, a position that had not had errors previously (side) was responded to with 0% correct responses on the posttest.

The program sequence of no fading with all positions cued therefore resulted in one subject (A) learning the simple relational positions to a criterion of 100% correct responses across two posttests. Subject H, who had a similar procedure (no fading all responses cued) but a different sequence, improved in the more frequently cued area (behind) but decreased correct responding in another (side).

The lack of replication by Subject H resulted in the experimenter dropping this procedure and using a fading technique in subsequent programs.

The next set of subjects was in the group where the fading of cue lights or buzzer was used with one, two or three positions only.

Subjects I and H were the two children run on training programs in which this occurred. Table I indicates that subject H's second program sequence (third row from top) contained four "back" and four "behind" trials randomly intermixed with two trials each of the four other positions. The program sequence was run over four days, making a total of 16 trials each for back and behind presentations and eight each for the other positions. "Back" and "behind" were cued with a red light over the response area. The intensity of the light across sessions was faded from full brightness to off in three steps simultaneously for both positions. That is, the light over the back-behind area (same light and same position but with different verbal labels by the experimenter) was faded from full intensity, to 2/3 intensity, to 1/3 intensity, to off, for both the back and behind trials. The intensity was the same amount on any one day for back or behind. This meant that both positions were faded at the same time (simultaneous) rather than one position first and then the other (successive).

Fig. 7 (bottom graph) shows the pre and posttest percent correct for each position (bars) and the percentage of correct responses during the four days of

----
Insert Fig. 7 About Here
----

the program sequence (third row of figures below the abscissa). During the pretest (solid bars) Subject H made errors to the side (100%). The program sequence contained more trials to the back-behind position because an error analysis of the pretest data indicated that Subject H was over-responding to the back-behind position. The posttest (dotted bars) data collected over two sessions (24 trials) indicated that Subject H responded 100% correctly to all relational positions.

Subject I had two three-step fading program sequences. Table I indicates that the first program sequence for Subject I was a three-step fading, one response cued program which contained six "front" trials randomly intermixed with two trials each of the other five positions. The program sequence was run over four days. Front was cued with a red light over the three-response areas of front (right, center, and left front lights). The intensity of the light was faded from full illumination to out in three steps in four sessions. Fig. 7 (top graph) shows the pre and posttest percent correct for each position (bars) and the percentage of correct responses during the four sessions of the program sequence (third row of figures below the abscissa).

During the pretest (solid bars) Subject I made errors to front (100%), behind (25%), side (12.5%) and back (12.5%). The program sequence contained more trials to front since the pretest data indicated that I was zero percent correct to this position. The posttest data (dotted bars) collected over one session (12 trials) indicated that I increased correct responding to front (50%) and back (100%) but decreased correct responding to behind (50%) and side (0%).

Since the first program was not successful (100% correct) in teaching the front position and in fact (on the posttest) resulted in less successful responding for positions behind and side, Subject I was given a second three-step fading program but with three responses (front, behind, and back) simultaneously cued instead of one (as in the first program). The sequence used during any one program session (Table I) had front presented six times while all other positions two times each. (In this sequence the order in which positions were presented was different from the first program but the number of times each position was presented was the same.) The program sequence was run over four sessions. The front position was cued with a flashing red light and the back and behind positions were cued with a buzzer. Although the side position had errors on the pretest for the second program, it was thought that side could be cued in a later program. Subject I was still making errors when behind instructions were given, so both behind and back were cued. In this program two different (sensory) modalities were used for the front position (visual) and the back/behind position (auditory). The use of two different sensory modalities was for the purpose of trying to make the front and the back/behind positions more discriminably different. The cues (flashing red lights and buzzer) were faded simultaneously in three steps from full brightness to off over the four-day training program. Fig. 7 (middle graph) shows the pre-posttest percent correct for each position (bars) and the percentage of correct responses during the four days of the program sequence (Rc row of figures below the abscissa).

During the pretests (solid bars) Subject I made errors to front (50%), behind (50%), and side (100%). During the program sessions Subject I made an error to the front position while the lights were still cuing the response. On the last day of the program sequence when all of the fading was complete (totally out) errors were made to both front and side.

Posttest data (dotted bars) collected over one session indicated errors to front (100%) and side (50%). Since the program was designed to train the front and the back/behind positions (not necessarily side) it is apparent that the program was not successful. Although the behind position was responded to correctly both during the program and on the posttest, the front position continued to have errors and when Subject I made an error to front it was incorrectly made to the back/behind position. Consequently it was decided that a slower fading procedure and only one position trained (front) may be more successful for this subject.

Subject I was therefore given a program sequence which had seven steps of fading and one response cued. Table I indicates that this program sequence was the same as Subject I's first front program. The difference was in the program sequence running over eight days with fading on seven. The front position was cued by a flashing red light over the position. Fig. 8 shows the pre and posttest percent correct for each position (bars) and the percentage of correct responses during the eight days of the program sequence (the Rc row of figures below the abscissa). The pretests (solid bars) show I made errors to front (100%) and side (50%). Only one error was made during the entire program sequence to the behind position (not cued in this program) and side, also not cued, had no errors (the Rnc row under the abscissa). The posttest data (dotted bars) collected over two sessions (24 trials) indicated that Subject I responded 100% correctly to all relational positions.

Insert Fig. 8 About Here

The third general training procedure involved the use of verbal instructions by the experimenter. Five subjects (B, D, E, G, and C) after a series of pretests were found to have one consistent error to the behind directions. Each subject, when behind was given, went to the side position of the house. Since these subjects demonstrated errors to only one simple relational position out of the six, it was decided that perhaps a simple verbal instruction of where the correct position was for behind may be effective and that programming was not necessary. The procedure used (Table 1) consisted of the experimenter presenting a sequence that had four back and four behind instructions and two trials each of the other four positions for subjects B, C, D, and E. Subject G had the pretest sequence, which meant that each of the six positions was presented twice. When the subjects were run on their sequences, the first error to the behind position resulted in the experimenter stopping the session and walking to the back/behind position of the house. He pointed to the response key for the behind position and told the child, "Here is behind, push here." The child then pushed the correct key and the house chime operated along with the reinforcer clown. The experimenter then said, "From now on when I say behind, push here." These instructions were only given once regardless of the behavior of each subject in that or subsequent sessions.

Fig. 9 indicates the correct responses for these four subjects on the pre-posttests and the intervening verbal instruction sequences. The top (subjects B, D, E, and G) and bottom (Subject C) graphs show that all had zero percent correct responses to behind on the pretest. Once the verbal instruction had been given for subjects B, D, E, and G (top graph), they made no further errors on the sequences (RV and RNV rows under the abscissa). The posttest for these subjects also was responded to at 100% for all positions including behind.

Insert Fig. 9 About Here

Subject C (lower graph), following the one instance of verbal instructions concerning the behind position, continued to make a few errors on the sequences. The middle bar labeled VS under behind and back indicates that errors continued to occur to both after the experimenter's instructions. However this subject was run on the sequence for three sessions and by the third day there were no errors to any positions even though no further instructions were given concerning either behind or back. The posttest data also indicate 100% correct responses for all positions. Subject C had served as a trial and error control in that she had been given 16 pretests (Fig. 4) before these verbal instructions. The only other errors that this subject had during these pretests were to back and side during the first pretest only. The following 15 pretests had 100% correct responses to back and side positions. When verbal instruction was given for the behind position, this subject then made errors on back by responding to side.

One of the control procedures used in this experiment was to assign a subject (with similar errors) to an experimental subject while the latter was being run on a training sequence. There were three subjects used in this manner. In Table I, under the control subject column, it can be seen that E served as a control for H's first program; D was a control for H's second program; and F as a control for Subject I. Also Subject E could be considered to be a control for the no fading - all positions cued procedure and D on F as controls for three step fading programs.

All of the control subjects were given the same sequence and instructions as their experimental subject except for the light and/or buzzer cue and fading procedures. Therefore these control subjects received the same number of trials and stimuli as their experimental counterpart but were run on essentially a trial and error basis. If the control subject was correct the reinforcement procedures were activated as during pre and posttests.

Fig. 10 (top graph) gives the percent correct of pre-p sttest and program

----

Insert Fig. 10 About Here

----

sessions for subject H. Bars 1, 2, and 3 are the pretest, program, and posttest data for Program 1 (all positions cued with no fading) and bars 3, 4, and 5 are the pretest, program and posttest data for H's second program (three step fading with two positions cued). The two bottom graphs give the control data for H's two programs (E for Program 1 left graph; and D for Program 2 right graph).

Control Subject E consistently made errors to the behind position during the pretest, control sequence and posttest, thus showing no improvement as a result of the control sequence. Also an error was made to under (second set of three bars) during the control sequence. When comparing E to the experimental Subject H it is not possible to say that the control sequence was less effective since H made errors on the side position on the posttest of Program 1. However, it is clear that the control sequence was not more effective than the program sequence.

Control Subject D (lower right graph) had two positions on the pretest (behind and side) that had errors. This subject received the control sequence for H's second program and as a result improved on the side position (100% correct) but not on the behind position (zero percent). The same sequence given to H under programmed procedures resulted in correct responding across all positions. D was not well matched to H for the second program since there was a difference in the number of positions that had errors on the pretests for the two subjects. However, considering the behavior of both of the controls (E and D) on their respective sequences, it appears that going through the control sequences resulted in no increased correct responding on two positions, slightly disrupted one, and improved one.

Fig. 11 gives the pretest, program (or control sequence) and posttest data

----
Insert Fig. 11 About Here
----

for experimental Subject I and control Subject F across each simple position. The front was the only position under programmed procedures for Subject I. The program for front was not successful since I had a posttest score of 50% on the front position. However, control Subject F also did not improve and in fact decreased in correct responding across the sessions (pretest 42%; control sequence 25%; posttest 0%).

DISCUSSION

The descriptive (pretest) data collected on the 19 subjects for the simple relational abstractions appeared to agree with past normative data. The age range of the subjects in this experiment would result in the prediction that some would respond correctly to all of the positions while others would still have some errors. The selection of the six positions used in this first experiment and the method of testing allowed for some further statements to be made concerning this descriptive data. The results on the first four pretests indicated that the "vertical" orientations (under and top) may be learned in our culture earlier by most preschoolers than those that seem to have a more "horizontal" orientation (front, behind, side and back). Also, since behind and back were located in the same position with respect to the house but were responded to differentially by the to-be-programmed subjects it would appear that the term back is perhaps more commonly used with preschoolers (at least those living in this section of the country).

Extended pretests on several subjects and the relative lack of overlap in pretest scores between the three groups (to-be-programmed; learned; and zero errors) indicated that those children who consistently made some errors would probably acquire those abstractions only after some other type of instructional procedure than trial and error feedback.

The three different training procedures used (all positions cued with no fading; fading of stimulus lights and/or buzzer; and verbal instructions) all had varied results.

One of two subjects was successfully trained when no fading was used but each position was cued. These results coincide with others (Etzel, Busby, and Cooper, 1971). That is, some subjects can learn errorlessly from cuing and maintain the acquisition even though fading of cues is not carried out. However the procedure has not been found to be effective for all children and therefore should probably not be generally applied or applied only in special circumstances.

The varied success of the four programs run that involved fading procedures resulted in several conclusions. The lack of success of Subject I's three step fading - one response cued program seems to be best attributed to the lack of instructional control during the running of that subject. As a result of I's behavior, a board on which two "happy faces" were painted was placed in the room. Each subject then was instructed to stand on the faces, then on signal make a response and then immediately return to the board. In essence this turned the session into a discrete trial experiment, whereas before multiple responses were made to one set of instructions and the trial and directions lost the advantage of a standard starting orientation, necessary in a study dealing with relational abstracting.

Subject I's second program may not have been completely successful because both cues were simultaneously faded across sessions. If only the programming of one response was involved then the issue of fading two cues at onec does not arise. For example, subject I's third program was successful when only one response was involved. However the number of fading trials was also increased so that the reason for acquisition is not clear.

Subject H's second program which had a three step fading program-with two responses cued did result in acquisition of all simple abstractions. The use of the same cue for two different directions (Back and Behine) may have made the two abstractions more similar. Therefore the subject responded to the same position only when those two instructions were given.

Verbal instructions given when only one position has errors appears to function in a similar way to the all positions cued - no fading procedure. That some instructional procedure is necessary seems apparent but in some cases minimal instructions may be all that are needed. Subject C's errors following verbal instructions may suggest that the procedure will succeed when only one position out of a group is not completely acquired. If other positions are not clearly, discriminated from the one being trained then instructions may lead to a breakdown in what previously appeared to be an acquired discrimination.

The subjects that served as controls for some of the programs were not as well mated to their experimental subjects as would have been desirable. However, the behavior of the control subjects on the control sequences alone, can permit the conclusion that exposure to a series of stimuli on a trial and error basis does not result in any immediate acquisition.

The carrying out of Experiment I resulted in a series of "hunches" regarding how to program the various complex positions for the same subjects in Experiment II. These hunches were then applied to a variety of programs and tested on more difficult discriminations.

EXPERIMENT II

Assessment and Training of Complex Relational Abstractions

Subjects

Of the 19 original subjects described in Experiment I, two (B and F) did not participate in Experiment II due to their withdrawal from the Preschool prior to the running of Experiment II.

Pretest

After having met the criterion of 100% correct responding to all positions on the simple relational abstractions, subjects were given two complex relational pretests over four sequences (making a total of 36 trials). Each sequence tested nine positions (left side, right side, left front, center front, right front, top left back, top left front, top right back and top right front). The occurrence of the positions in the sequence was alternated between two orders. A copy of the complex pretest data sheet is found in Appendix 4. The method of administration and reinforcement procedures for the complex pretest are the same as used in Experiment I.

Training

A variety of programs were developed based on an error analysis of each subject's complex pretests. The programs were designed to teach such responses or ask questions regarding: 1.) The acquisition of correct responses to a positional instructional chain (e.g. top - right - back); 2.) The use of successive as opposed to simultaneous fading procedures; 3.) The effectiveness of requiring a subject to engage in a verbal - motor chain; 4.) The effect of overlap in fading during successive procedures; 5.) The effectiveness of different cues for different positions being taught in the same program; and 6.) The effect of teaching one position(s) on the acquisition of other complex positions.

Each of the subjects and their programs will be discussed in more detail at the time the data is presented since there are few general procedures common to all subjects. However, the various procedures used in the fading of the cues can be summarized as follows.

Fading of lights (or buzzer), when more than one response was cued, was carried out under two general procedures: Simultaneous and successive. In simultaneous fading, the intensity was the same amount for all of the positions being cued. Thus both positions were faded at the same time (e.g. both would be 2/3 of the original intensity on the same day). In successive fading one position was faded while the other(s) remained at full intensity. For example on any one day one position may be down 1/3 of the original intensity while the other is still at full intensity. There was also a slight variation of procedure between subjects that were on successive fading. Some subjects had an oveflap in fading on two positions while others had total fading of one position before the other position light or buzzer started to decrease in intensity. For example, if overlap occurred in successive fading then one position would have faded to totally out while the other position light would have started it's fading down to 1/3 of its original intensity within the same session.

Design

The training design for Experiment II was basically the same as that used in Experiment I. That is, each program or control sequence was evaluated by a pre-posttest procedure; some programs were run on more than one child; and control subjects were run on control sequences at the time the experimental subjects were being run. Table II summarizes the experimental history for each subject that did not meet criterion on the complex relational pretests.

RESULTS

Descriptive Data on Complex Relational Abstractions

Of the 17 subjects identified by letters from A through S (Fig. 12),

Insert Fig. 12 About Here

76% or over three fourths of the population were placed in the to-be-programmed group since they did not obtain 100% correct responses on their last pretest (two sequences). This group (subjects A through O) had a mean of 34% correct responses to the complex positions of left side, right side, left front, right front, center front, top left back, top left front, top right back, and top right front, while their individual percentages ranged from 14 to 72%.

Subjects P,Q, and R (18% of the total group) met the criterion of 100% correct responding on two successive sequences of the pretests. These subjects mean was 87% on the 36 trials with individual percentages ranging from 83 to 93%. No subject from the To-Be-Programmed group had an individual percentage correct as high as the lower percentage correct in the subjects who learned group.

One subject (S) made no errors during the pretests. Of the 17 children in this study more than 3/4 (77%) had very few consistently correct responses to the complex positions.

Fig. 13 shows percent correct for each of the two complex pretests

Insert Fig. 13 About Here

(four sequences) for individual subjects in the To-Be-Programmed and Learned groups. The three subjects who were placed in the learned group (lower row of three graphs) tended to have initially higher percentages of correct responses and the more typical acquisition curves. The to-be-programmed group tended to have fairly flat curves, showing no trends toward acquisition across the pretests.

Fig. 14 presents data from additional pretests given to subjects D,

Insert Fig. 14 About Here

E,G,I,M, and N from the to-be-programmed group. All of the subjects except N showed an increase in percent correct on the additional pretests. Three of the five tended to level out or decrease after this increase. However, no subject from this group reached a percentage equal to that of the lowest individual percentage of the group of subjects who learned.

Fig. 15 shows the percent correct on additional pretests for those subjects

Insert Fig. 15 About Here

who learned. After achieving 100% correct responding no subject from this group ever made an error even though the additional pretests numbered as many as 14.

Fig. 16 shows the percent correct across two pretest (four sequences)

Insert Fig 16 About Here

by position for the subjects to-be-programmed and subjects who learned. The data are plotted by each complex relational position on each of the four sequences of the two pretest. The dotted lines represent the data for the subjects who learned and the solid curve for the subjects to-be-programmed. The one position with the least discrepancy between the two populations was center front. The four top related positions show the greatest discrepancy between the two groups. When the pretest data was analyzed it indicated that the children to-be-programmed were not responding to the "Top" part of the verbal instructions (e.g. Top Right Back), whereas the subjects who were responding to the three positional instructions.

Experimental Training Data on Complex Relational Abstractions

Pretest error analysis indicated that the to-be-programmed subjects had the most difficulty with the top positions. These were the only positions that contained three terms (all other complex stimuli contained two). It was also apparent that the to-be-programmed subjects tended to respond primarily to the back/behind position when instructions for top-left-back or top-right-back were given. Consequently two subjects (O and E) who both demonstrated this error pattern when given the top instructions were chosen for study. O received a top-right-back program (Table IIa, second row) while E served as the control. The program sequence was given over six sessions with five steps of fading on the flashing red light. The light and the response key were located on top of the roof of the house, and on the left back side of the slanting roof. A program sequence consisted of five trials of top-right-back and one each of the other complex positions (except for top-left front which had two trials each).

Fig. 17 presents the pre-posttest and program data for subject O and

----
Insert Fig. 17 About Here
----

the control sequence and program for subject E. Subject O had no correct responses on the pretest while E had only 25% correct. The program was responded to 100% correctly across the six sessions by subject O, while the control sequence had 20% correct responses by E. The posttest for O remained at 100% correct responding while E continued at 25%.

Subject E was then given the same series of sequences but this time with the cues and fading procedures. The program and posttest were responded to at the 100% criterion level.

A series of different positional programs were carried out with either simultaneous or successive fading procedures. Three subjects (J, L, and D) received a simultaneously faded program for right front-center front and left side - right side. Out of the three programs one was successful in teaching the discrimination. Fig. 18 (for Subject J) and Fig. 19 (for Subjects L and D) show the pre-posttests and program data. For Subjects L and J the simultaneous program was presented first in their experimental history. Subject D first served as a control for L then was trained on L's simultaneous program. It was this latter subject whose program and posttest responses indicated that the discrimination was learned.

Insert Figures 18 and 19 About Here

There were nine successively faded programs run on left side - right side; top left - top right; right front - center front; and top left back - top right back. Subject J's second and third programs (Fig. 18); Subject L's second program (Fig. 19); Subject I and D (Fig. 20); Subject H and N (Fig. 21); and Subject A and K (Fig. 22); all had successive programs where the fading was not carried out on the two cues at the same time. Out of these nine programs seven were successful while two (Subjects A and L; Figures 22 and 19) improved their posttest over the pretest but not to the 100% criterion level. Although the successive programs (as compared to the simultaneous programs)

Insert Figures 20, 21, and 22 About Here appear to have had a higher success ratio, there were a variety of other variables that may have effected these results. One in particular was the number of sessions involved in the two procedures. For example since fading of both cues was carried out simultaneously then the number of sessions for all simultaneous programs was four. On the other hand the successive programs had either six or seven sessions.

Both programming and trial and error procedures that have included a chained response have found that successful responding is usually increased by this technique. Two subjects (L and M) were given programs which included a required verbal response. Before the "go" light went on the subject had to give a verbal response. Subject L (Fig. 19) had this required verbal response added to programs three and four. For example, on program three when the experimenter gave the instructions the subject had to repeat the position before the "go" light would come on, thus permitting the subject to then respond. In program four only the left front position had the verbal chain connected to the procedure. Subject M (Fig. 23) was successful in learning the left front - right front discrimination when the verbal chain was inserted prior to the pushing (motor) response. The use of the required verbal response in each of the programs was under slightly different conditions. For Subject L in program three it was added to the sequence when only one response was being cued. In program four it was the manipulation for the left front response while the flashing light cued the right front response. Subject M had a successive program when both flashing light and buzzer were cues for right front and left front respectively with the verbal-motor chain being tied to the left front position and no verbal response to the right front position.

Insert Fig. 23 About Here

In all programs where this verbal chain was added to or was the only procedure, the subject learned the position to 100% criterion. It should be noted that three sessions of instructions preceded the left front - right front program (Fig. 23) of Subject M. This was a similar procedure as used with some subjects during the simple programs. However, the presession verbal instructions were given for two positions (as opposed to one during the simple programs), left front and right front. The instructions also included the demonstration of the position. This procedure did not result in any correct responses (on left and right front) and therefore the program with the verbal-motor chain was given. The lack of success with this instructional procedure may have been due to the fact that two (not one) positions were being instructed.

The question of whether or not the overlapping of fading by the two cues on a program would disrupt the behavior during a program was considered. The data indicate that out of five programs that had overlap three resulted in no disruption of behavior during the program (Subjects D, H, and N, Figures 20 and 21 respectively). In contrast, of the programs that had no overlap of fading on the cues, four were successful and one was not. The four programs that did not disrupt behavior during the program were run on Subjects M, A, K, and J; Figures 23, 22, and 18. From these results it would appear that no consistent trent appeared since both procedures were almost equally successful.

There were ten programs that utilized different cues (light or buzzer) when teaching more than one position. Also there were four programs that had the same cue for two different positions. Those subjects that had programs with the same cues (J, D, and L; Figures 18 and 19) for both positions had a 50-50 chance of success. On the other hand where different cues for different positions were used the ratio improved to 75% correct (Subjects J, I, D, H, M, N, K, L, and A; Figures 18 through 23).

The last analysis made on the data concerned the effect of the acquisition of one or more relational abstractions on the acquisition of other complex abstractions. In Fig. 24 the increase and decrease of percent correct responses from pretests to final posttests on nonprogrammed stimuli is plotted. The series of bars on the left were all of the experimental (hatched) subjects and their controls (dotted bars). The subjects on the right were those that had no controls with their programs. The data was calculated by taking all of the positional items on the complex pretest that were not being subsequently programmed and arriving at a percent correct for those items only. Then after the program, a percent correct for those same nonprogrammed items was obtained. These two percentages were then subtracted so that if the posttest percentage was larger on the nonprogrammed items then the difference was assigned a plus and was plotted on the upper side of the abscissa. If the percentage of nonprogrammed items was larger on the pretest then the percentage was assigned a minus and plotted on the bottom side of the abscissa. For example Subject A (the first bar) increased correct responding 42% on nonprogrammed items from the pretest to the posttest. However A's control lost 10% correct responding on nonprogrammed items. Subject H (experimental) increased 50% while H's control decreased 5%. Subject O increased 22%. However, O's control also increased (35%) and by a larger amount. This increase in correct responding on nonprogrammed items by this control subject was the only increase observed on the part of a control subject. That is, except for this subject, controls either lost or showed no difference (e.g., Subject D) between pre and posttests.

Insert Fig. 24 About Here

On the other hand, subjects who had an intervening program clearly showed increases also in correct responding on nontrained positional items. Out of 12 programs only one experimental subject (L) showed either no increase or a decrease from pre to posttests on nonprogrammed stimuli. However, this same subject on later programs did show transfer effects.

This effect seemed to hold whether or not the nonprogrammed stimuli were also presented (but not trained) in the program (between the pre-posttests) or whether the subject had no experience with them except on the pre-posttests. The asterisk (*) under Subject O and E's bars and also under L_4 and J_3 (or control sequences for Subject E) indicate where the programs contained these nonprogrammed items. All other programs by the other subjects on the graph contained only the complex positional item that was being programmed and simple positional items that the subject had already acquired.

One further example of how acquisition of some complex relational discriminations will effect others is seen in Fig. 25. The graph is a summary of

Insert Fig. 25 About Here

Subject J's experimental history on the complex stimuli. Subject J had three programs, two on the center front - right front positions and one on the top left back - top right back positions. As a result of these programs the percentage of correct responses on other positions increased across the four sets of tests until on the last test (number four) all positions were being responded to at 100% correct (indicated by the hatched square) with the exception of the left front position that was 75% on the final test. The effects of these three programs was most clearly seen on such other positions as top left front - top right front; left side - right side and left front. Since none of these were ever programmed it would seem that training on some positions did influence the acquisition of other complex positions.

DISCUSSION

The complex descriptive data obtained on the 17 subjects indicated that, in fact, these types of relational positions were more difficult for preschoolers in the three and four year range. Extended pretests did not result in any clear acquisition. Most of the children did not even respond to the initial term of a three term positional direction. The analysis of a variety of error patterns and some programming issues raised in Experiment I resulted in a series of questions being asked while programs were being constructed to teach the complex relations. One program was developed to train a subject to come under the control of all three stimulus terms in a complex direction. This was a successful program and part of this may be due to the fact that only one complex position was being programmed rather than a discrimination between two complex abstractions within the same program (such as top right back - top left back). However, it appears to be a fairly easy procedure to bring a child under the control of a three term relational abstraction and once this response is acquired then discriminations between several three term abstractions could be programmed.

The more successful programs seemed to be those that were designed so that successive fading of cues occurred rather than a simultaneous fading. The actual reason for this however was not investigated in this study and remains a problem for future experimentation. The variables that may have effected the results could have been: number of sessions (which were longer for the successive programs); only one fading process occurring at a time and therefore the subject may have been more likely to have transferred control of the cue to the actual complex stimulus position; different or same cues for different stimulus positions; the order in which a subject received the simultaneous or successive program (e.g., first or second in experimental history). These latter variables were not systematically controlled and could have attributed to the variance in some respect.

Successive fading, as carried out in most of these programs, seems more likely to succeed. Also it does not appear that a slight overlap in the fading processes of two cues will result in program errors. Consequently, there may be a point somewhere between complete overlap (simultaneous fading) and a one session overlap in the fading of two cues where optimal learning will occur and yet with maximum efficiency (fewer trials or sessions).

The additional requirement of a verbal-motor chain in the responding to a programmed sequence may be a method of adding a stimulus (the subject's own verbal response) to help cue responses. This procedure should be investigated furthef since it has the advantage of the subject almost carrying his or her own stimulus with him to use when other cues may have faded out or been removed.

The fact that children who were programmed in complex relational abstractions also gave evidence of acquiring other (nontrained) abstractions (while the controls did not) tends to emphasize the following position. It is not so much the "developmental level," the "readiness factor" or some neurological growth or lack thereof that determines whether or not a three or four year old can learn complex relational abstractions. Rather, it is how one arranges the learning environment.

REFERENCES

Boone, Daniel R. On the other hand. *Journal of the Kansas Medical Society*, 1965, *66*, 132-135.

Castner, B. M. Language development. In A. Gesell (Ed.), *The First Five Years of Life*. New York: Harper and Brothers, 1940, pp. 233-234.

Engle, T. L. *Psychology Its Principles and Applications*. (4th ed.) New York: Harcourt, Brace and World, 1964.

Etzel, Barbara C., Busby, Karen and Cooper, Alita Y. Individual preacademic assessment: a functional analysis. Unpublished manuscript. *Progress Report*, *KCRECE*, *University of Kansas*, Department of Human Development, November, 1971.

Hilgard, E. R. *Introduction to Psychology*. (3rd ed.) New York: Harcourt, Brace and World, 1962.

Terrace, H. S. Discrimination learning with and without "errors". *Journal of the Experimental Analysis of Behavior*, 1963a, *6*, 1-27.

Terrace, H. S. Errorless transfer of a discrimination across two continua. *Journal of the Experimental Analysis of Behavior*, 1963b, *7*, 223-232.

FOOTNOTES

[1] This study was supported in part through the University of Kansas Center for Research in Early Childhood Education, in association with the United States Office of Education (CEMREL, Inc., Grant Numbers OEC 3-7-070706-3118 and OEC 0-70-4152 607).

[2] The fading of lights and buzzer was accomplished by the use of calibrated potentiometers. In the case of the light, to decrease the intensity equally across the range from full illumination to totally out, a light bank consisting of three lights was built into a control box. This bank of lights was wired in series with the potentiometer and each light could be put into the circuit independently by switches. This allowed the same current drainage if four, three or two lights were on (e.g., when side was cued two lights were illuminated on the house and two lights were illuminated on the control board, giving a current drainage equal to four lights). The calibration was then carried out by turning the potentiometer until the lights that were to be cues were visually out. Then the number of steps that were to be the fading sequence were divided into the number that the potentiometer pointed to on its own scale at totally out position. For example, if the lights were visually out at point 30 on the potentiometer scale and the program called for three fading steps, then the first fading step moved from zero (or full intensity) to 10, the second to 20 and the third to 30. The buzzer was faded in a similar manner. The lights upon which the fading and calibration was carried out were G-E 1819,28v., .04 amps. The buzzer was constructed in the shop by the experimenter and was basically a 6v oscillator module wired in conjunction with a PM speaker.

Table Ia

Summary of experimental history for each subject who did not meet criterion behavior on simple relational pretest

Program Subjects	Control Subjects	Type of Program	Cue	Program or Control Sequence Per Session*
A		Front No fading All positions cued	Continuous red light over front position	F, U, T, F, S, U, F, BA, T, F, S, B, F, U, F
H	E	Behind (1st program) No fading All positions cued	Continuous red light over behind position	U, T, B, S, BA, B, F, T, B, U, B, F, S, B, BA, B
H	D	Back-Behind (2nd program) Three step fading Two positions cued	Continuous red light over back-behind position	U, T, B, S, BA, B, F, T, BA, U, B, F, S, BA, B, BA
I	F	Front (1st program) Three step fading One position cued	Continuous red light over front position	F, U, T, F, S, B, F, BA, T, B, F, S, BA, F, U, F
I		Front, Back, Behind (2nd program) Three step fading Three positions cued	Flashing red light over front position. Steady buzzer over back-behind position	U, F, T, F, S, B, F, BA, T, B, F, S, BA, F, U, F
I		Front (3rd program) Seven step fading One position cued	Flashing red light over front position	(Same sequence as I's 1st front program)

Table Ib (continued)

Program Subjects	Control Subjects	Type of Program	Cue	Program or Control Sequence Per Session*
B		Behind sequence No fading One position cued	Verbal instructions for behind position	U, T, B, S, BA, B, F, T, BA, U, B, F, S, BA, B, BA
C		(Same sequence as B)	(Same sequence as B)	(Same sequence as B)
D		(Same sequence as B)	(Same sequence as B)	(Same sequence as B)
E		(Same sequence as B)	(Same sequence as B)	(Same sequence as B)
G		Pretest sequence No fading One position cued	Verbal instructions for behind position	F, U, B, T, S, BA, U, T, B, F, S, BA

*Key

F = front

U = under

T = top

BA = back

S = side

B = behind

Table IIa

Summary of experimental history for each subject who did not meet criterion behavior on complex relational pretest

Program Subjects	Control Subjects	Type of Program	Cue	Program or Control Sequence Per Session*
A	K	Positions cued: LS; RS Sessions: 7 Six step fading: Left side first; then right side (successive). Intensity of cues faded in three steps each, with no overlap in fading of light and buzzer.	Buzzer LS; Flashing red light RS.	U, T, LS, B, F, RS, BA, T. RS, B, LS, U, F, RS, BA, LS
O	E	Position cued: TRB Sessions: 6 Five step fading: Intensity of cue faded in five steps.	Flashing red light TRB.	RS, TRB, CF, TLF, TRB, RF, TRB, TLB, LS, TRB, TRF, LF, TRB, TLF
H	N	Positions cued: TL; TR Sessions: 6 Five step fading: Top left first, then top right (successive). Intensity of cues faded in three steps each, with overlap of fading both light and buzzer on 4th session.	Buzzer TL; Flashing red light TR.	U, S, TL, B, F, TR, BA, S, TR, B, TL, U, F, TL, BA, TR

Table IIb

Program Subjects	Control Subjects	Type of Program	Cue	Program or Control Sequence Per Session*
L	D	Position cued: LS; RS Sessions: 4 Three step fading: left side, right side (simultaneously). Intensity of cues faded in three steps.	LS, RS Continuous red light	U, T, LS, B, F, RS, B, BA, T, RS, B, LS, U, F, RS, BA, LS
L		Position cued: LS, RS Sessions: 7 Six step fading: Left side first; then right side (successive). Intensity of cue faded in three steps each with no overlap in fading of light and buzzer.	LS flashing red light RS buzzer.	U, T, LS, B, F, RS, B, BA, T, RS, B, LS, U, F, RS, BA, LS
L		Position cued: LS Sessions: 6 Five step fading: Intensity of cue faded in five steps. Verbal motor chain required in five of the six sessions.	LS flashing red light plus chained verbal motor response.	U, T, LS, B, F, RS, B, BA, T, RS, B, LS, U, F, RS, BA, LS
L		Positions cued: LF, RF Sessions: 5 Four step fading: Intensity of cue faded in four steps. Verbal motor chain required in four of the five sessions.	LF chained verbal motor response RF flashing red light.	RF, LS, TLB, CF, TRF, RS, TRB, LF, TLF, CF, TRB, LS, TRF, TS, LF, TLF, RF, TLB

Table IIc.

Program Subjects	Control Subjects	Type of Program	Cue	Program or Control Sequence Per Session*
M		Positions cued: LF, RF Sessions: 8 Seven step fading: Left front first then right front (successive). Intensity of cue faded in three steps each, with no overlap in fading of light and buzzer. Verbal motor chain required during seven of the eight sessions.	LF buzzer plus chained verbal motor response. RF flashing red light.	U, LF, BA, RF, T, LF, RS, RF, B, LF, CF, RF, LS, RF, CF, LF
I	D	Positions cued: LS, RS Sessions: 6 Five step fading: Right side first then left side (successive). Intensity of cue faded in three steps each, with overlap of fading both light and buzzer on the fourth session.	RS buzzer LS flashing red light.	U, T, LS, B, F, RS, BA, T, RS, B, LS, U, F, RS, BA, LS
J		Positions cued: RF, CF Sessions: 4 Three step fading: Right front, center front (simultaneously). Intensity of cue faded over three of the four sessions.	RF and CF both cued by continuous red light.	BA, T, RF, S, CF, U, B, RF, T, BA, CF, S, U, CF, B, RF
J		Positions cued: RF, CF Sessions: 6 Five step fading: Right front first then center front (successive). Intensity of cue faded in three steps each with overlap of fading of the RF light and CF light on the fourth session.	RF and CF both cued by continuous red light.	BA, T, RF, S, CF, U, B, RF, T, BA, CF, S, U, CF, B, RF

Table IId

Program Subjects	Control Subjects	Type of Program	Cue	Program or Control Sequence Per Session*
J		Positions cued: TRB, TLB Sessions: 7 Six step fading: Top left back then top right back (successive). Intensity of cue faded in three steps, each with no overlap in fading of light and buzzer.	TLB buzzer TRB continuous red light	TLB, RF, TLF, LF, RS, TRF, LS. TRB, CF, TLF, LF, TRB, RS, TRF, CF, TLB, LS, RF
C		Complex pretest only. Used subjects for descriptive data only.		
G		Complex pretest only.		

*KEY

F = front

U = under

T = top

B = behind

S = side

BA = back

LS = left side

RS = right side

LF = left front

CF = center front

RF = right front

TLB = top left back

TLF = top left front

TRB = top right back

TRF = top right front

Fig. 1: Percent correct on four simple relational pretests for subjects-to-be-programmed, for subjects who learned and for subjects who had zero errors. The range averages and means, for the three groups are given in the boxes. The bars are of individual percentages.

Percent Correct on Four Pretests (Simple Relational Concepts)

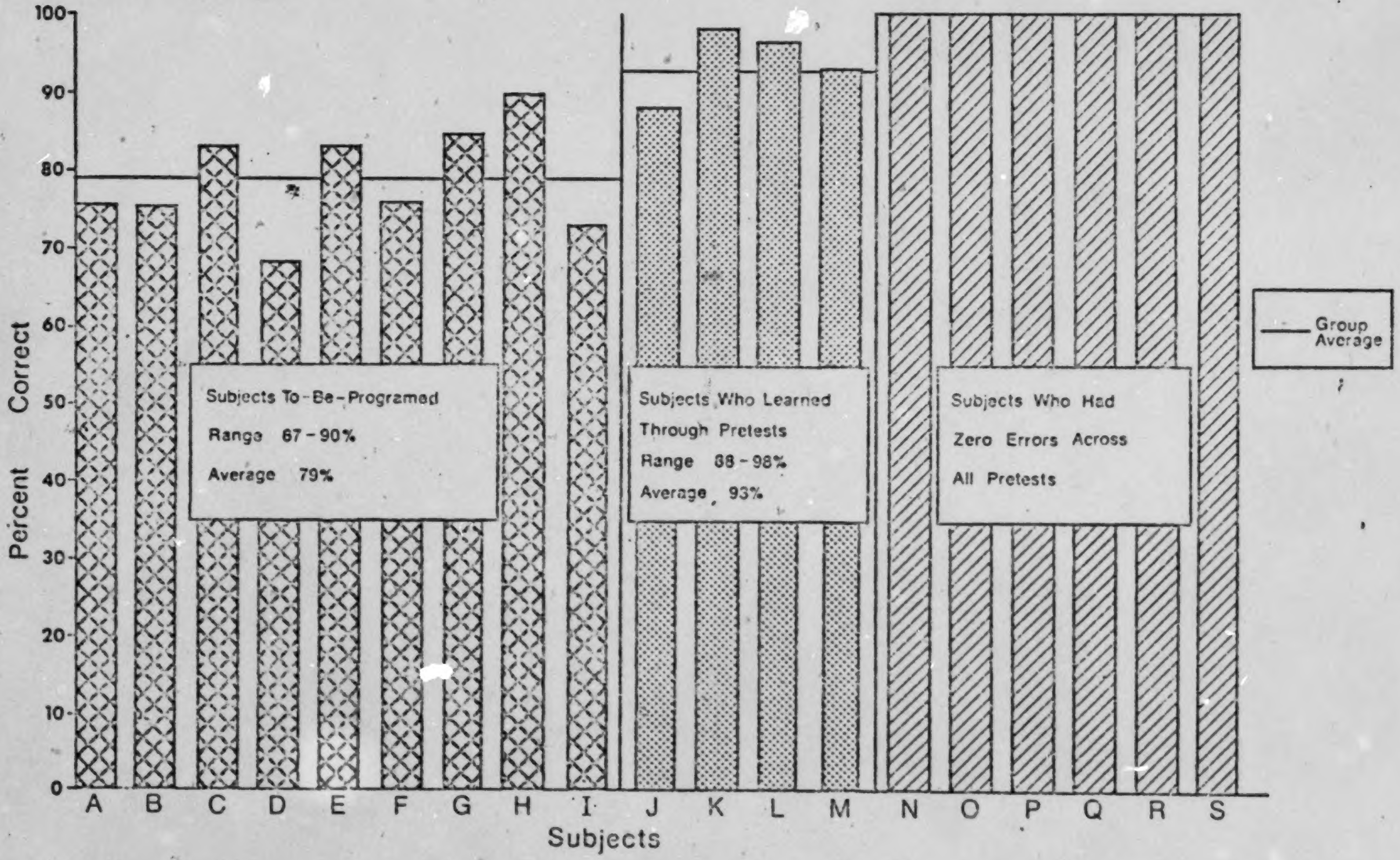
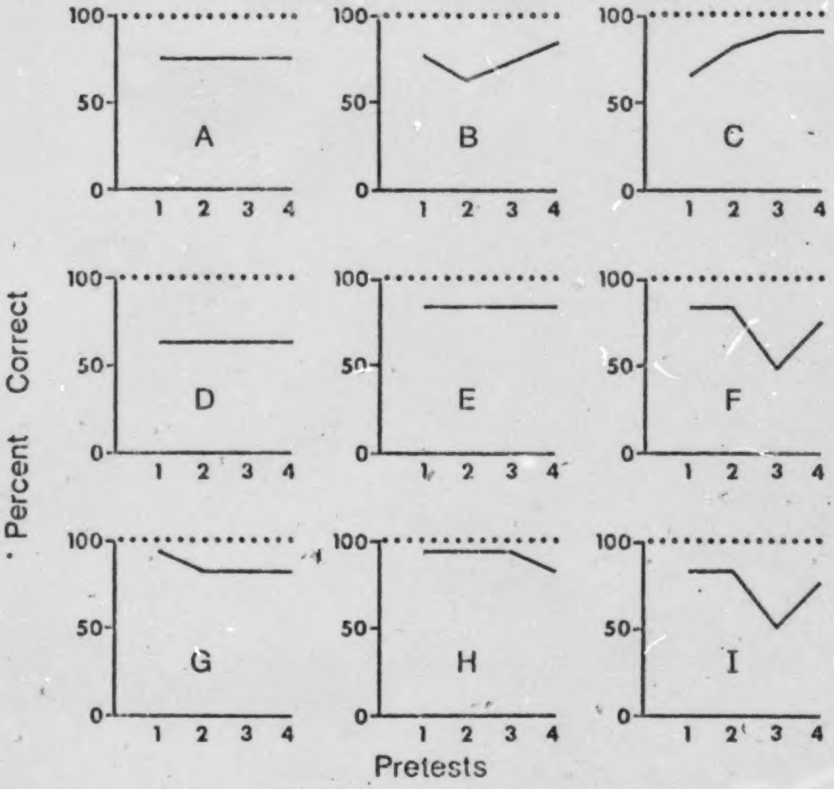


Fig. 2: Individual percent correct of simple relational concepts across four pretests by groups, subjects to be programmed and subjects who learned through pretests.

Percent Correct of Simple Relational Concepts Across Four Pretests for Individual Subjects

To-be-Programed Subjects



Subjects Who Learned Through Pretests

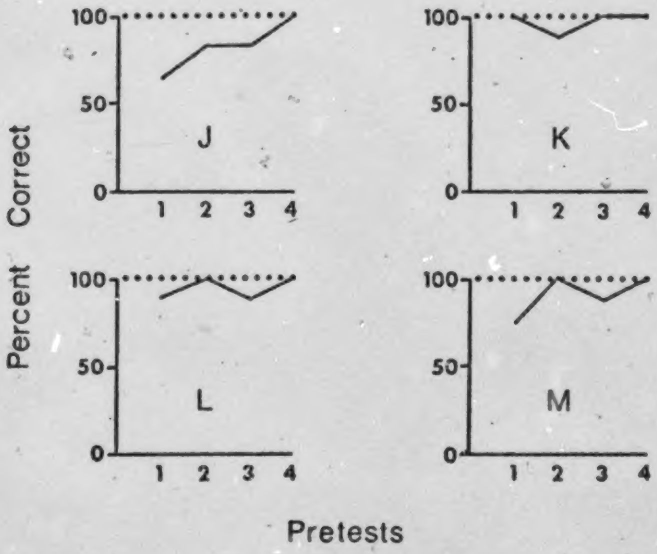


Fig. 3: Percent correct and individual comparison across subjects-to-be-programmed and subjects who learned on first four pretests and additional pretests of simple relational concepts.

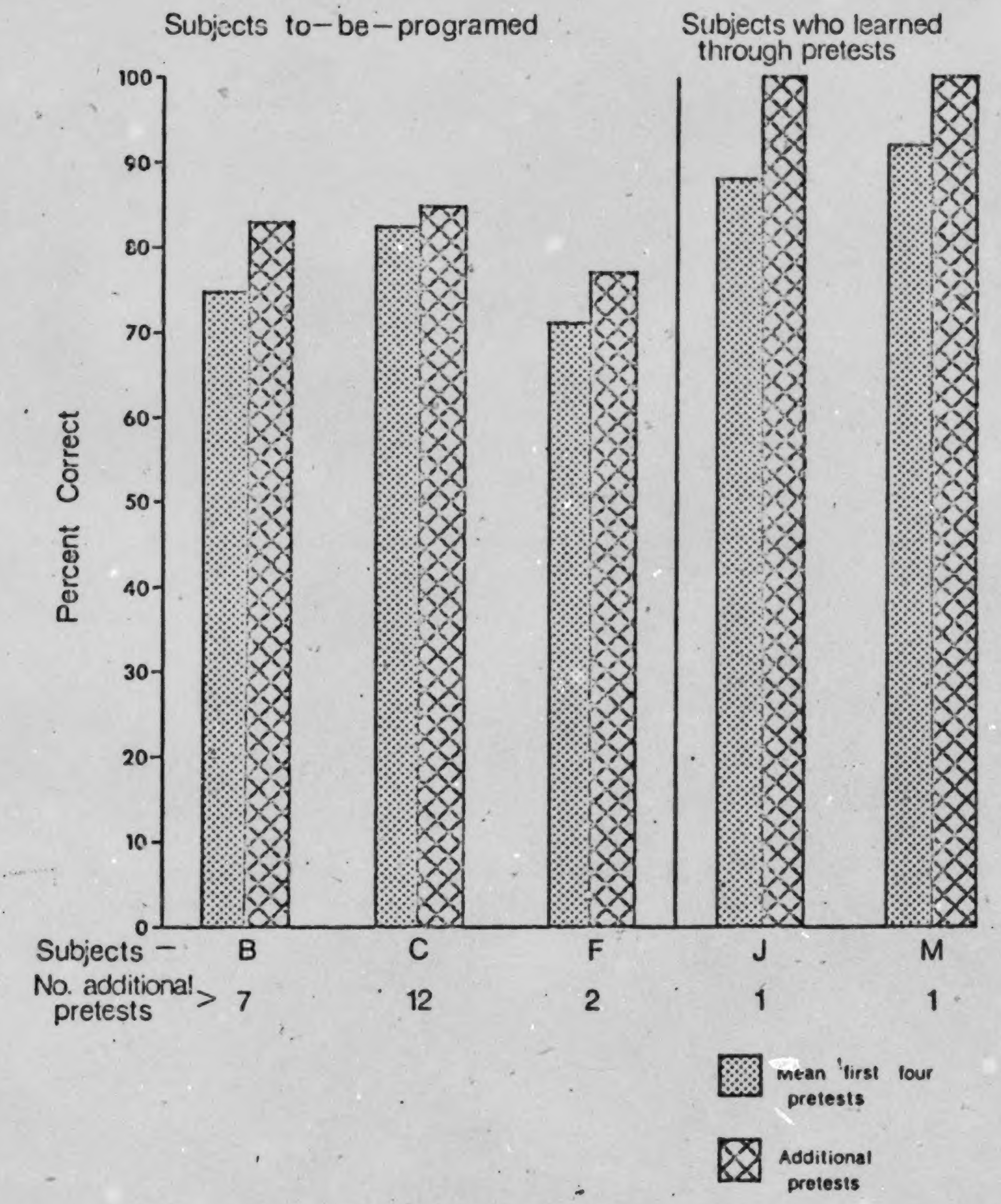

Percent Correct on First Four Pretests and Additional Pretests for Individual Subjects on Simple Relational Concepts

Fig. 4: Simple relational concepts percent correct across extended pretest for Subjects B and C.

Percent Correct of Simple Relational Concepts
Across Extended Pretests for Two Subjects

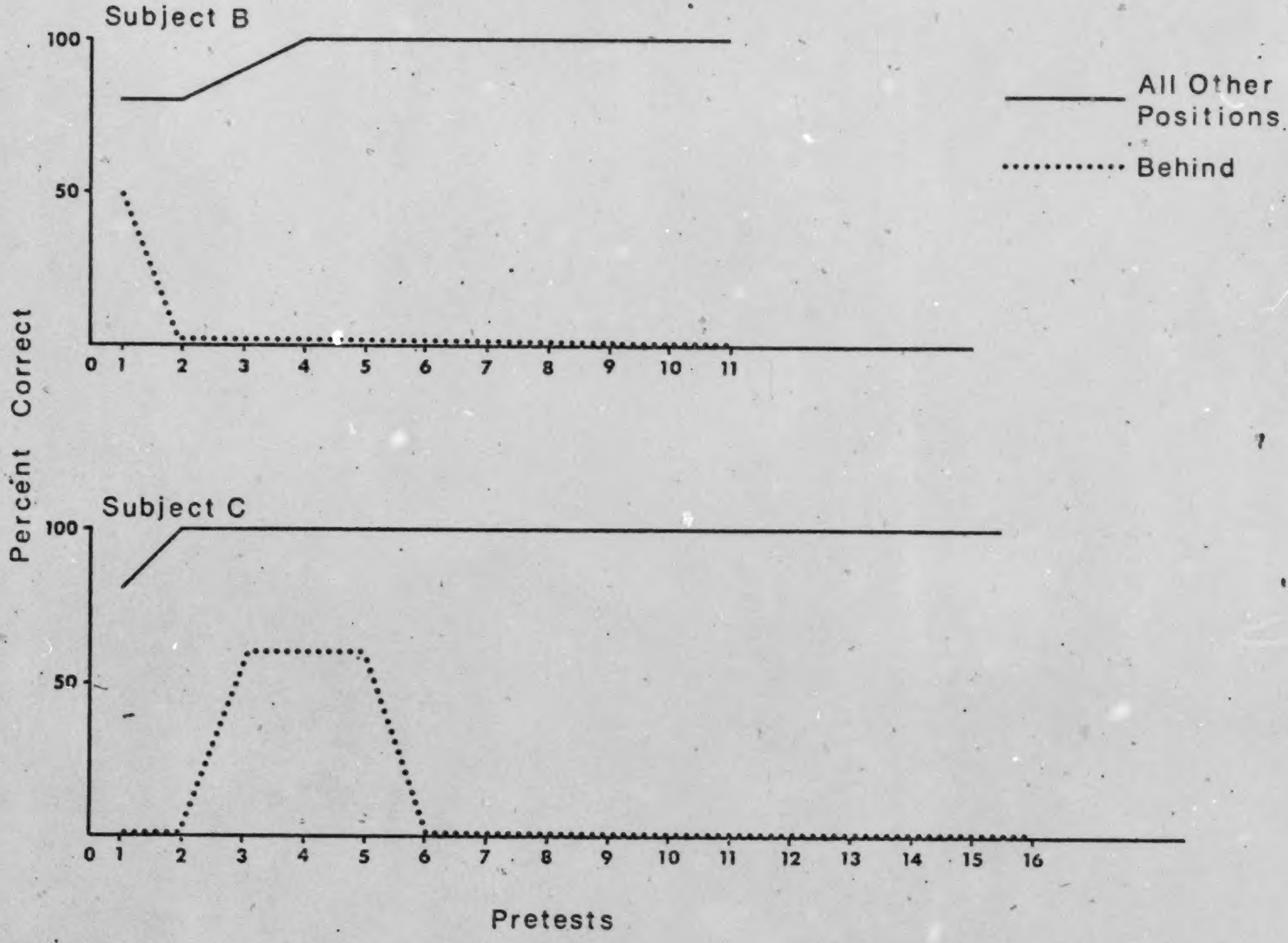


Fig. 5: Relational concept position percent correct across four pretests for subjects-to-be-programmed and subjects who learned during pretests.

Percent correct across four pretests by position for subjects to-be-programed and subjects who learned during pretests

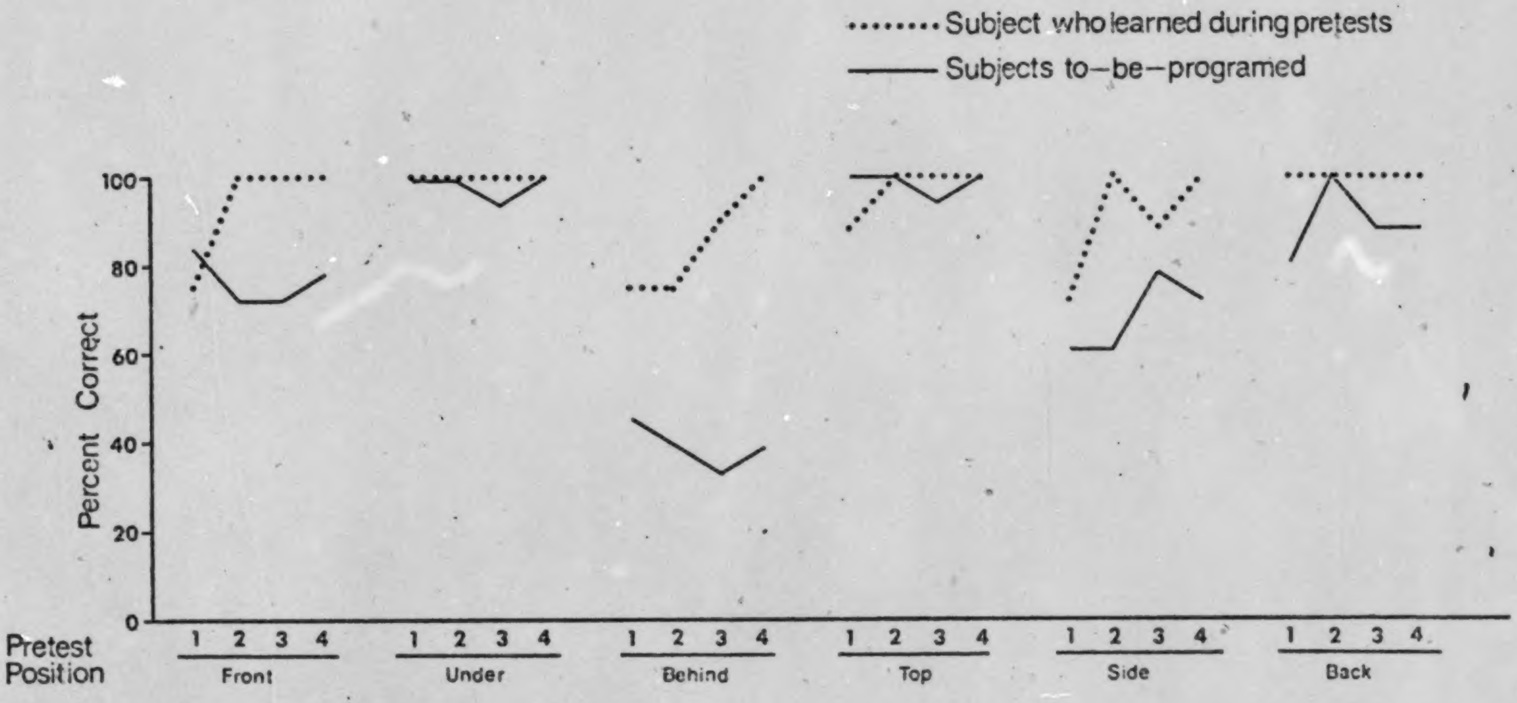


Fig. 6: Subjects A and H percent correct on pre-and posttest and intervening program (no fading, all responses cued).

Percent Correct On Pre and Posttests
Intervening Program: No Fading
All Responses Cued

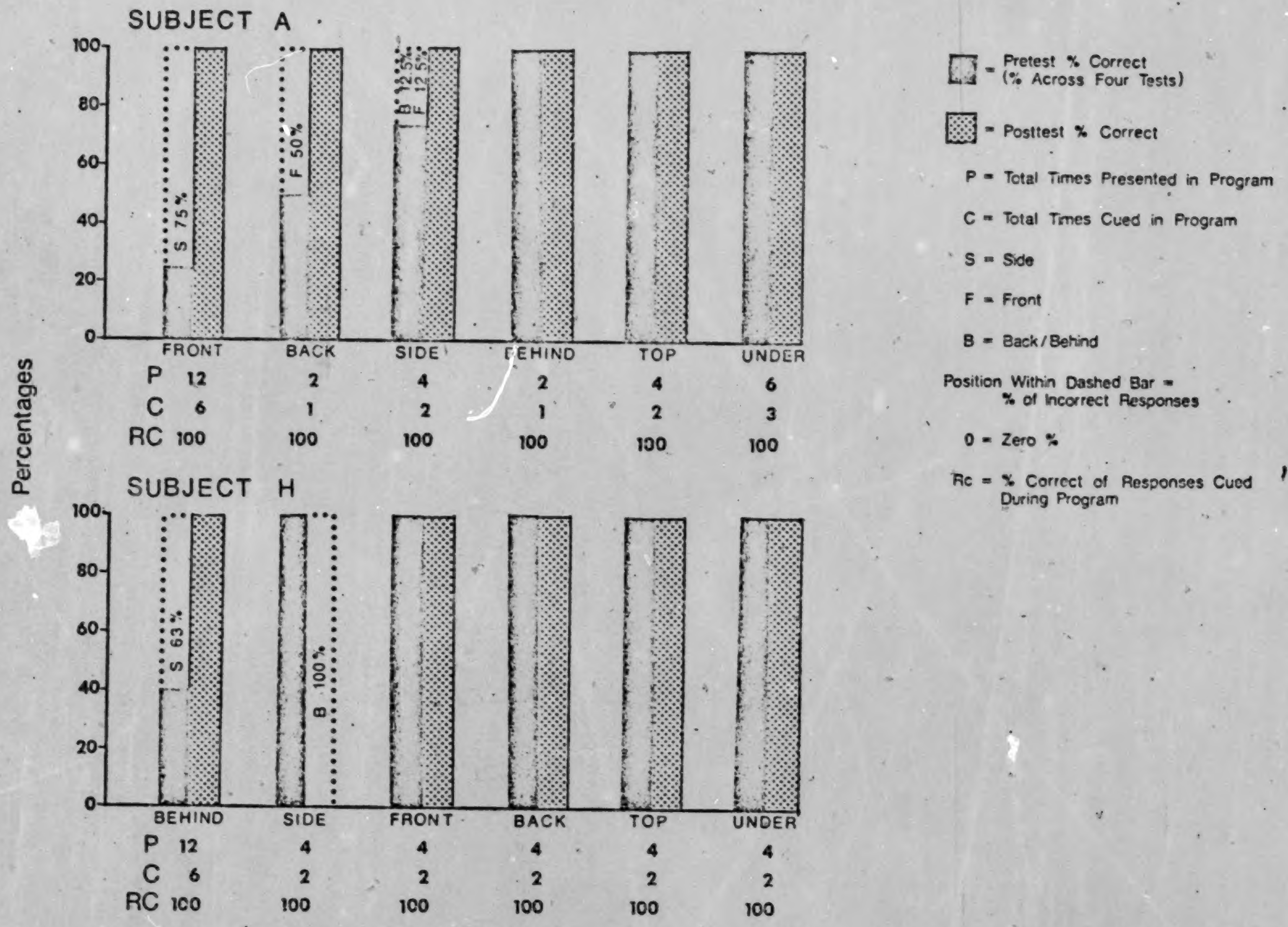


Fig. 7: Percent correct on pre- and posttest and intervening programs in which three step fading was used for Subjects I and H.

Percent Correct on Pre and Posttests
Intervening Program : Three Step Fading

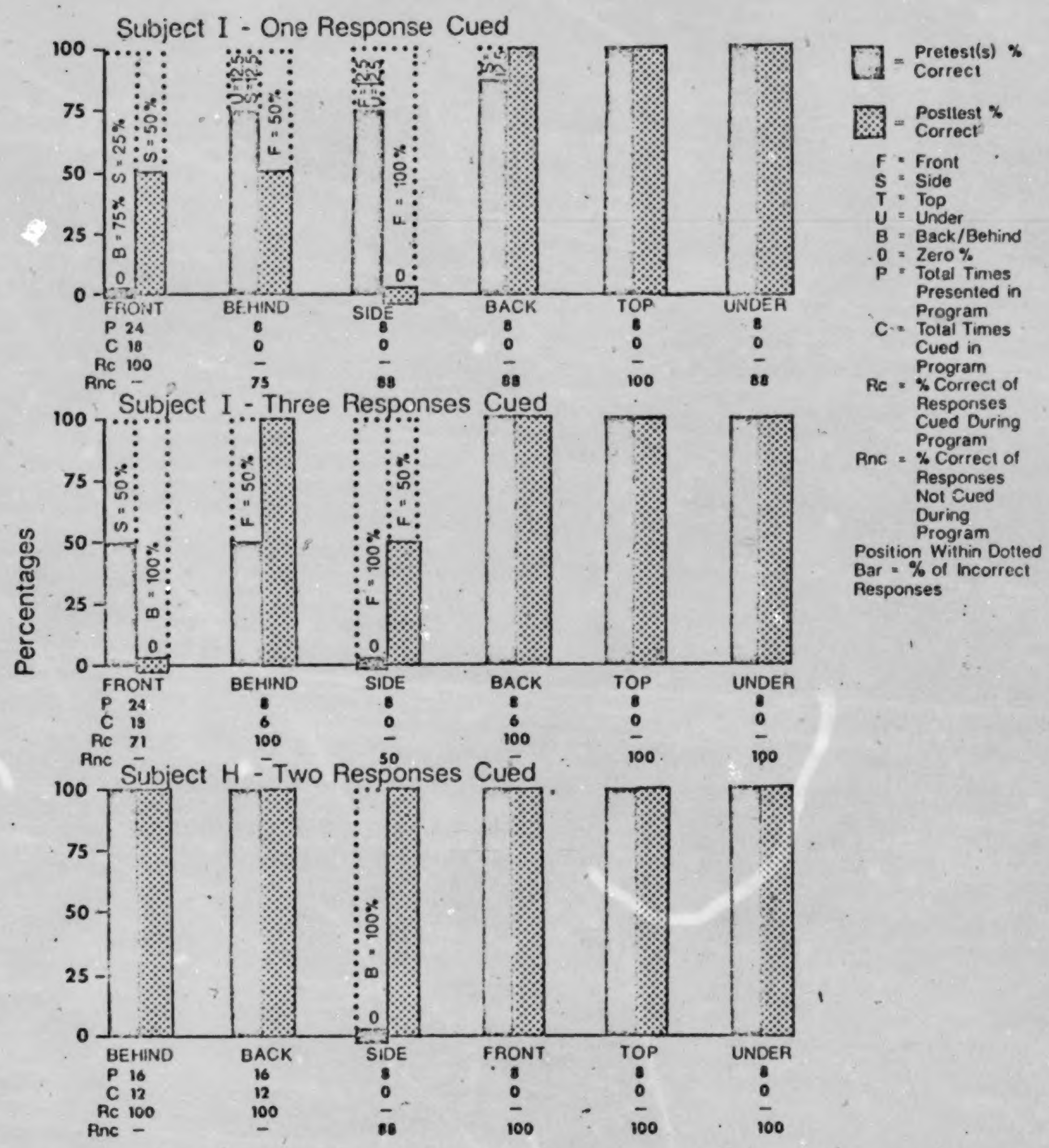
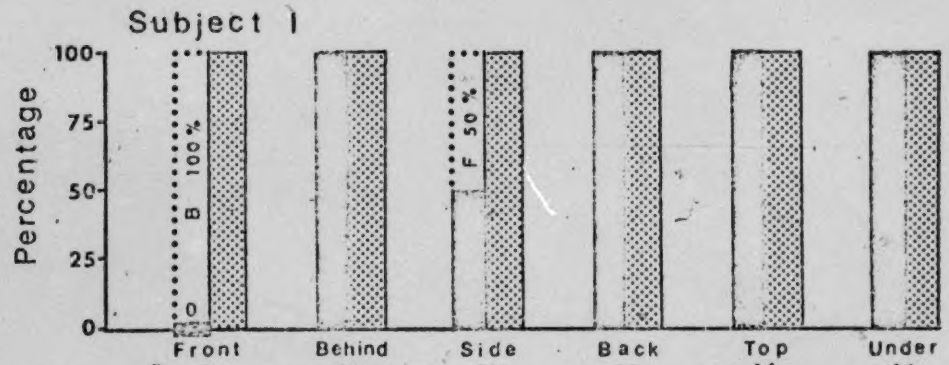


Fig. 8: Percent correct on pre- and posttest and intervening program (front) in which seven step fading was used for Subject I.

Percent Correct On Pre and Posttests Intervening Program: Seven Step Fading, One Response Cued



	Front	Behind	Side	Back	Top	Under
P	48	16	16	16	16	16
C	42	0	0	0	0	0
Rc	100	—	—	—	—	—
Rnc	—	94	100	100	100	100

Rc = % Correct of Responses Cued During Program

Rnc = % Correct of Responses Not Cued During Program

Position Within Dotted Bar = Position and % of Incorrect Responses

0 = Zero %

▬ = Pretest

▨ = Postest

B = Back / Behind

F = Front

P = Total Times Presented in Program

C = Total Times Cued in Program

Fig. 9: Percent correct on pre- and posttest for Subjects (B, D, E and G) having intervening verbal instructions.

Percent Correct On Pre–Posttest And Intervening Verbal Instruction Sequence

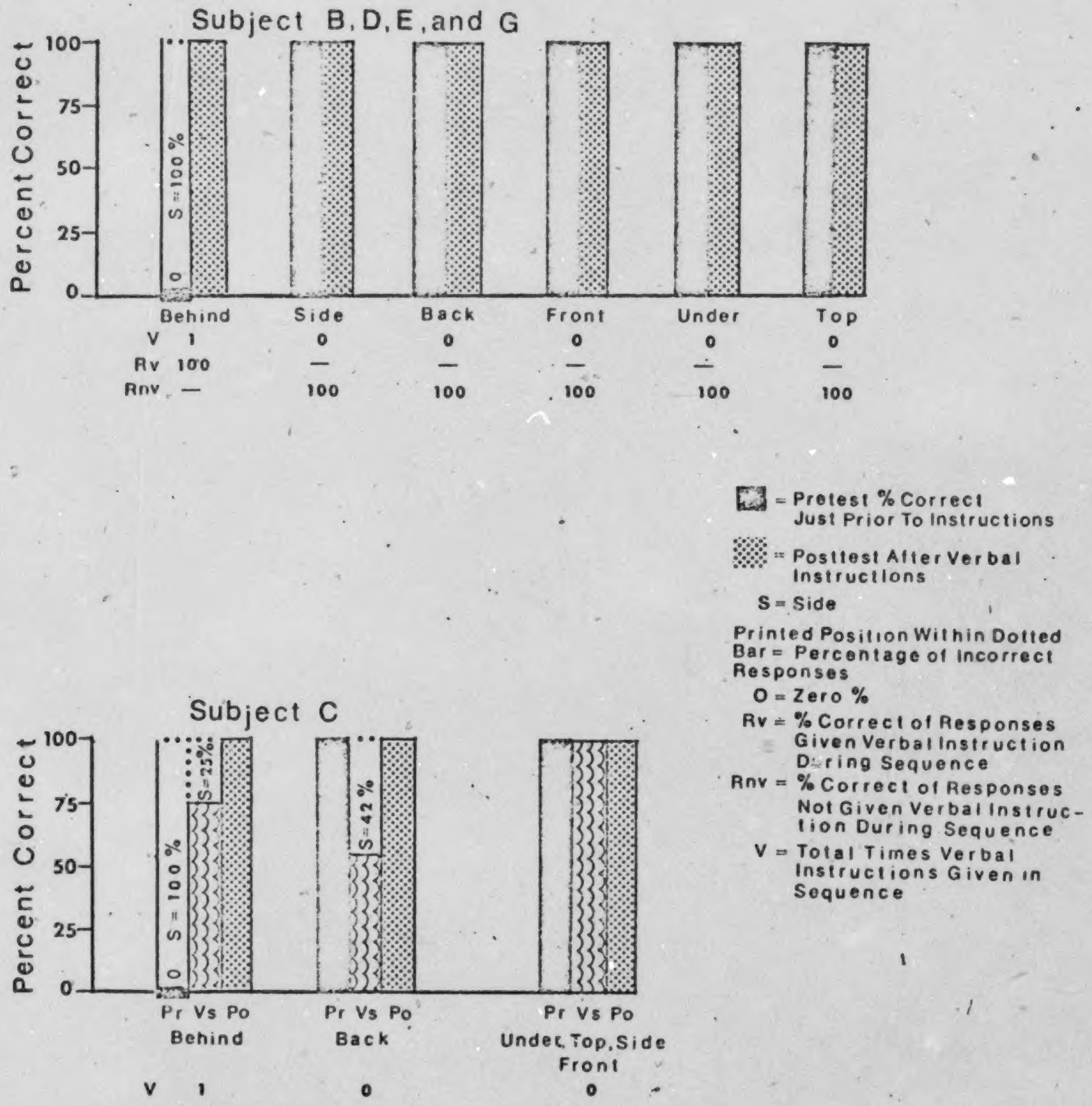


Fig. 10: Comparison of programmed and nonprogrammed (Control) sequences for Subject H (Front-Back/Behind) programs.

Comparison of Programmed and Nonprogrammed (Control) Sequences

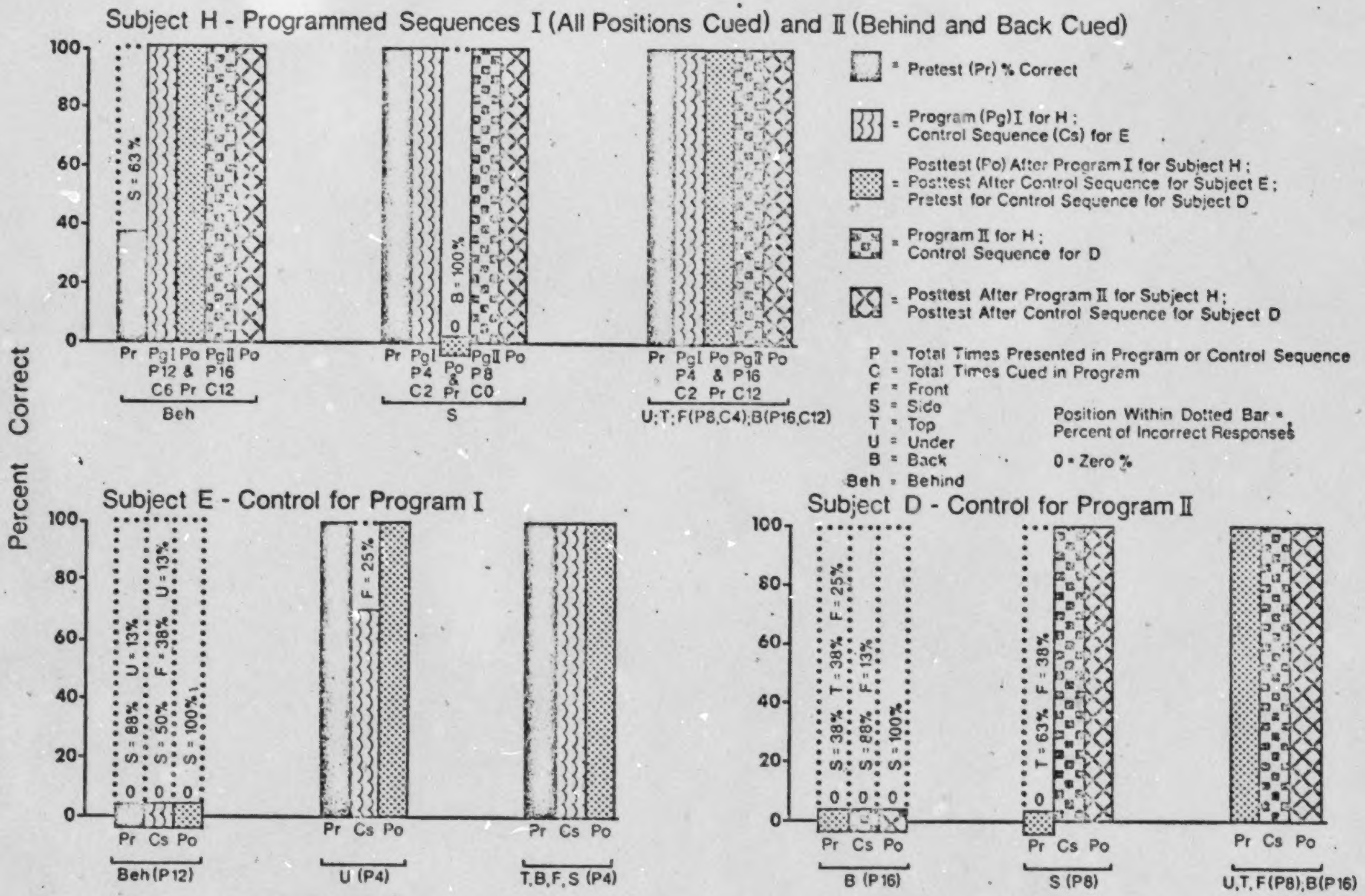
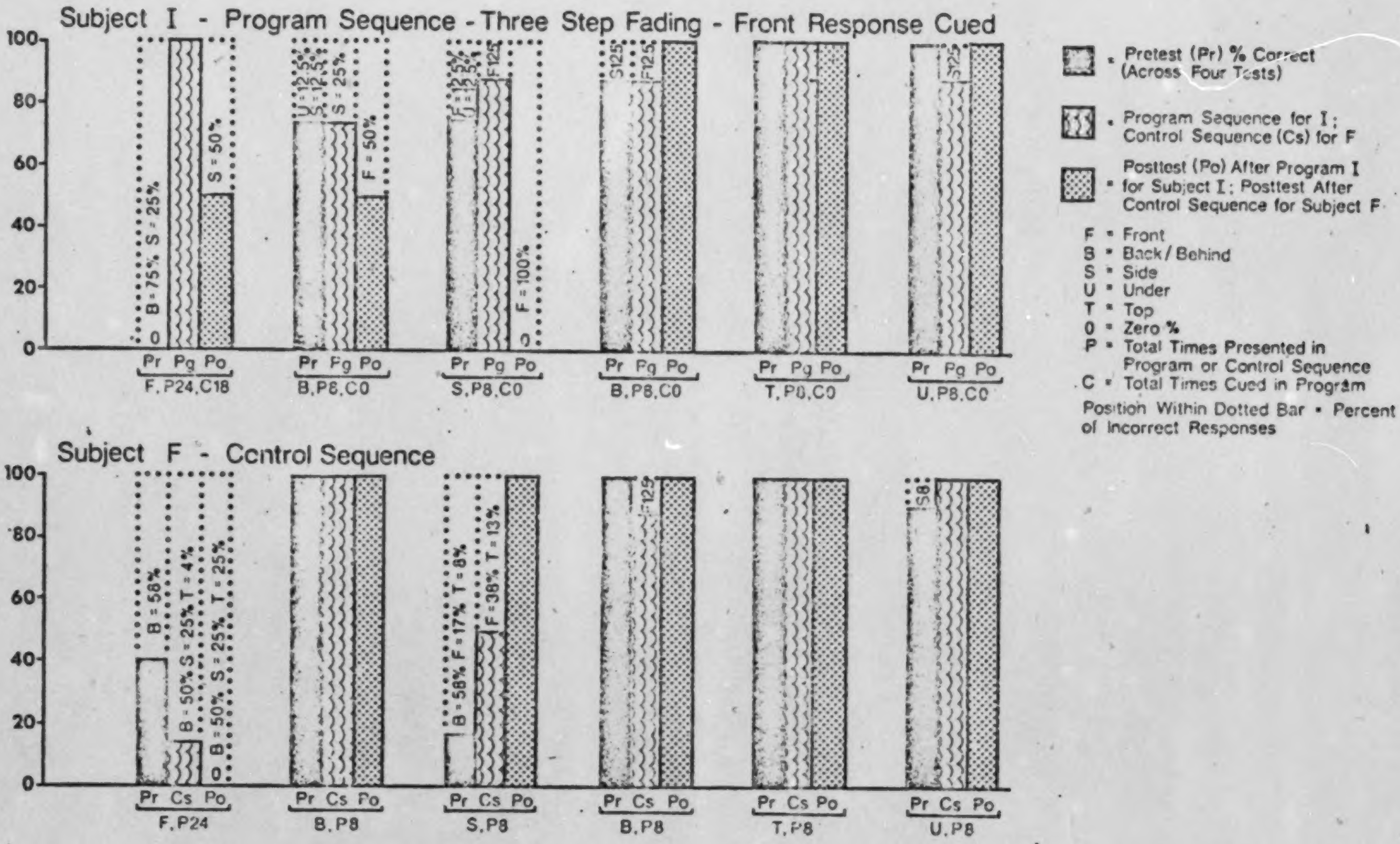


Fig. 11: Comparison of three step fading program and nonprogrammed (Control) sequences for Subject I.

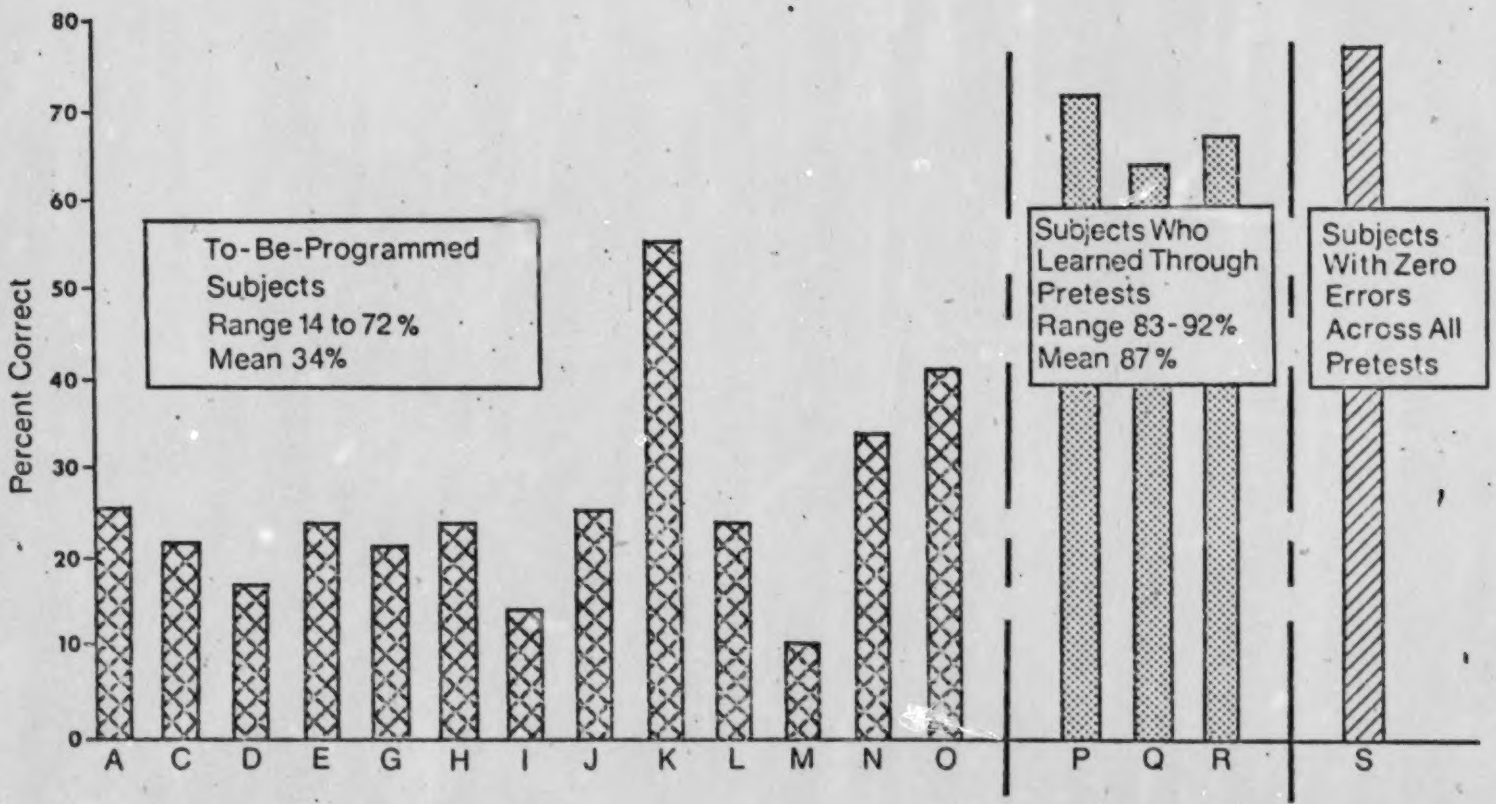
Comparison of Programmed and Nonprogrammed (Control) Sequences



Subject I - Program Sequence - Three Step Fading - Front Response Cued

Subject F - Control Sequence

Fig. 12: Percent correct on two complex relational pretests (four sequences) for subjects-to-be-programmed, for subjects who learned and for subjects who had zero errors. The range average means for the three groups are given in the boxes. The bars are of individual percentages.

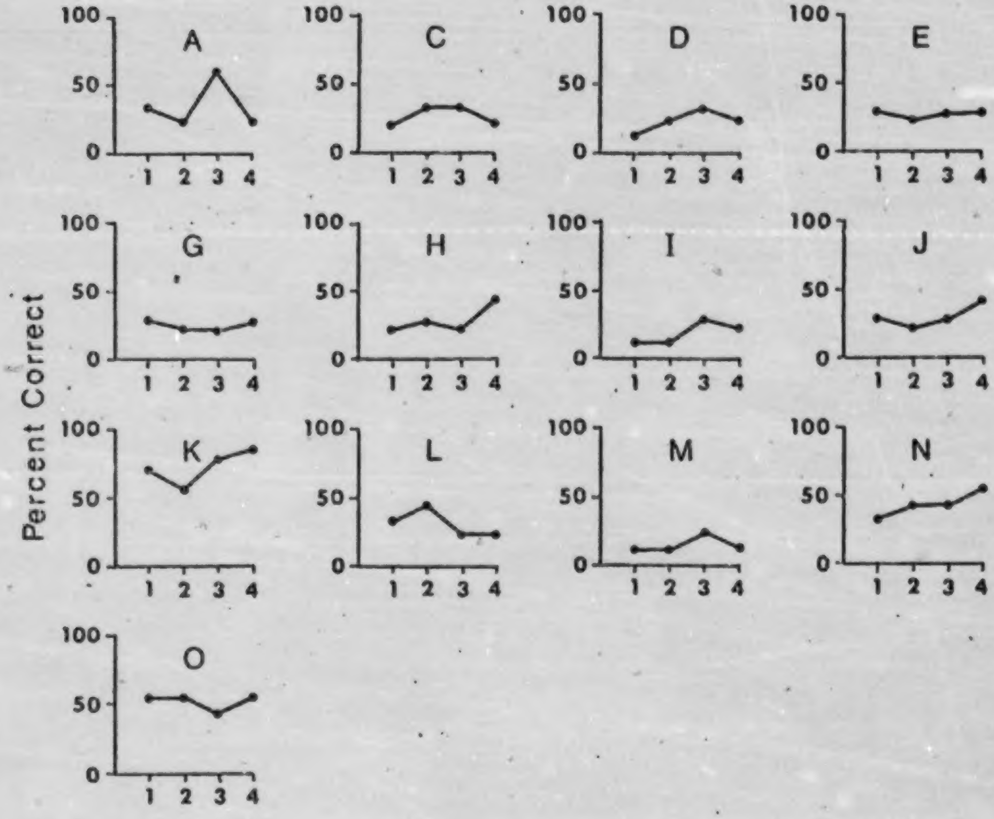


Percent Correct
80
70
60
50
40
30
20
10
0
A
C
D
E
G
H
I
J
K
L
M
N
O
P
Q
R
S
To-Be-Programmed Subjects
Range 14 to 72 %
Mean 34%
Subjects Who Learned Through Pretests
Range 83-92%
Mean 87 %
Subjects With Zero Errors Across All Pretests

Fig. 13: Individual percent correct of complex relational concepts across two pretests (four sequences) by groups, subjects-to-be-programmed and subjects who learned through pretests.

Percent Correct Complex Relational Concepts Across Two Pretests (four sequences) For Individual Subjects

To-Be-Programmed Subjects



Subjects Who Learned

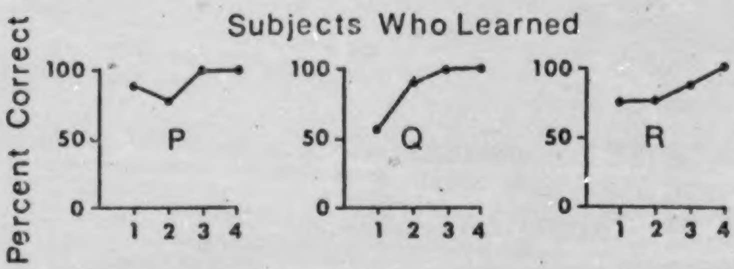


Fig. 14: Percent correct on first two pretests and additional pretests for individual subjects on complex relational concepts.

Percent Correct on Two Pretests and Additional Pretests for Individual Subjects on Complex Relational Concepts

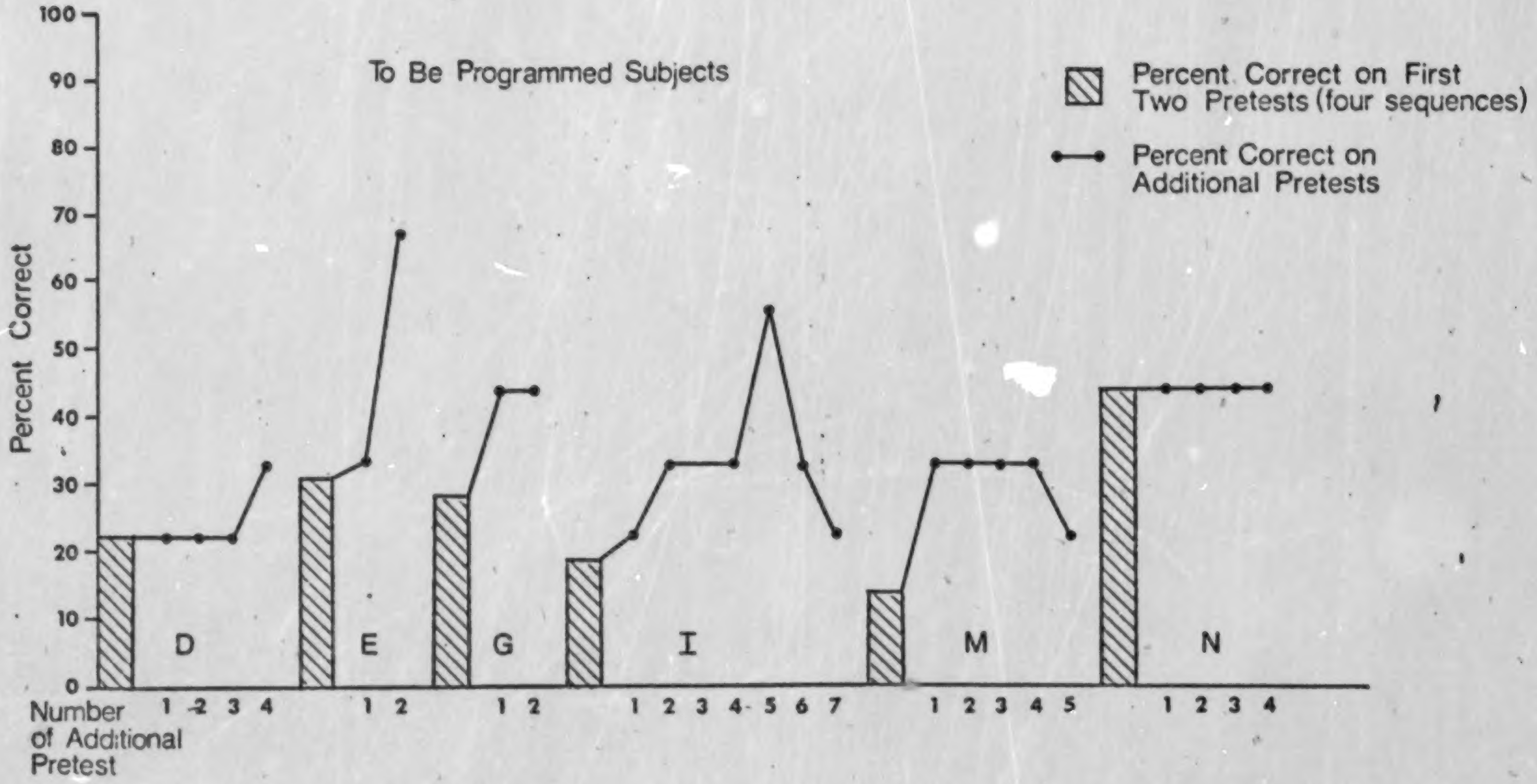


Fig. 15: Percent correct on additional complex pretests for subjects who learned on first two pretests.

Percent Correct on Additional Pretests by
Subjects Who Learned on First Two Pretests

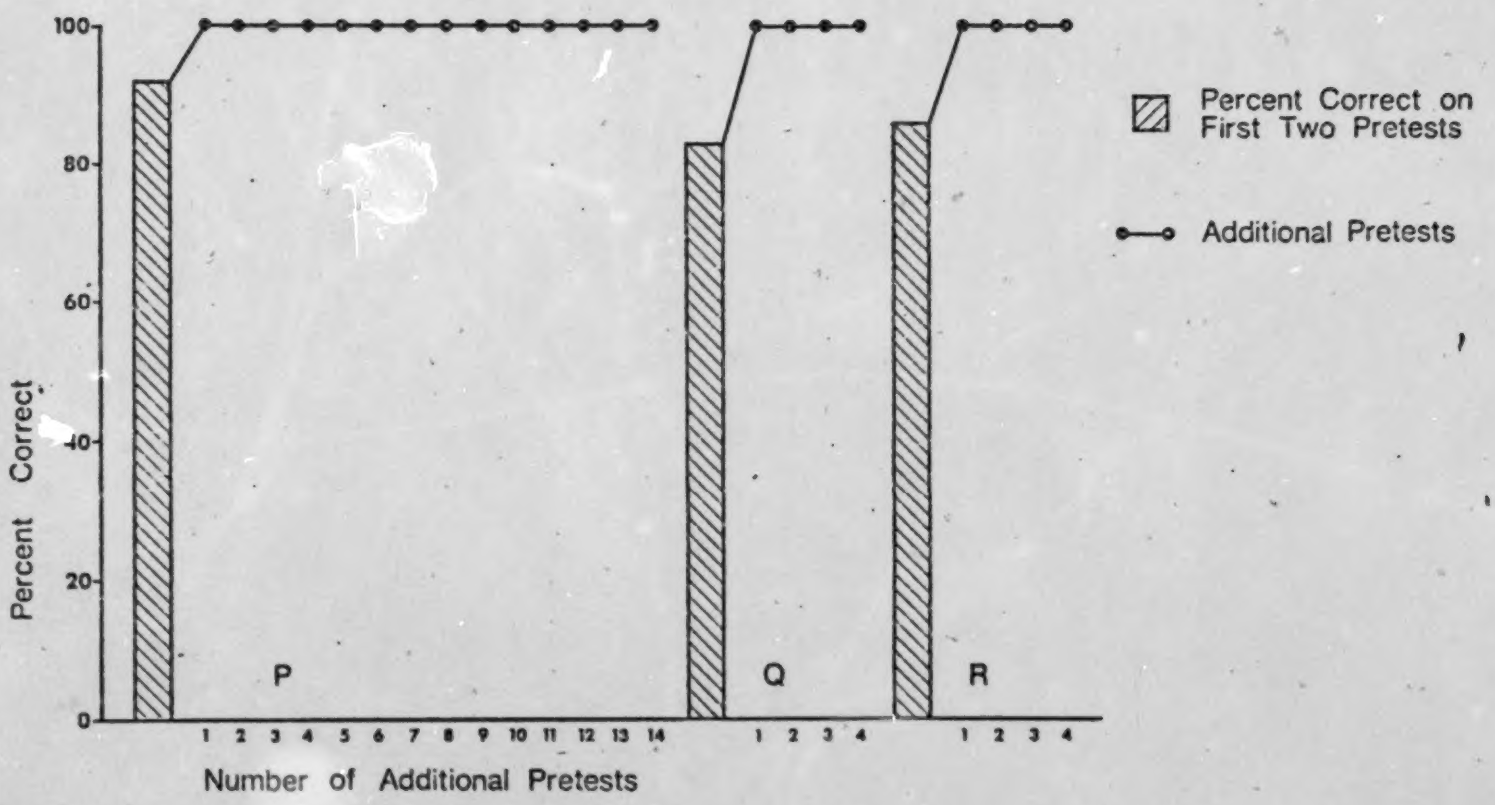


Fig. 16: Percent correct across two pretests (four sequences) for subjects-to-be-programmed and subjects who learned during pretests.

Percent Correct Across Two Pretests (four sequences)
For Subjects To Be Programmed And Subjects
Who Learned During Pretests

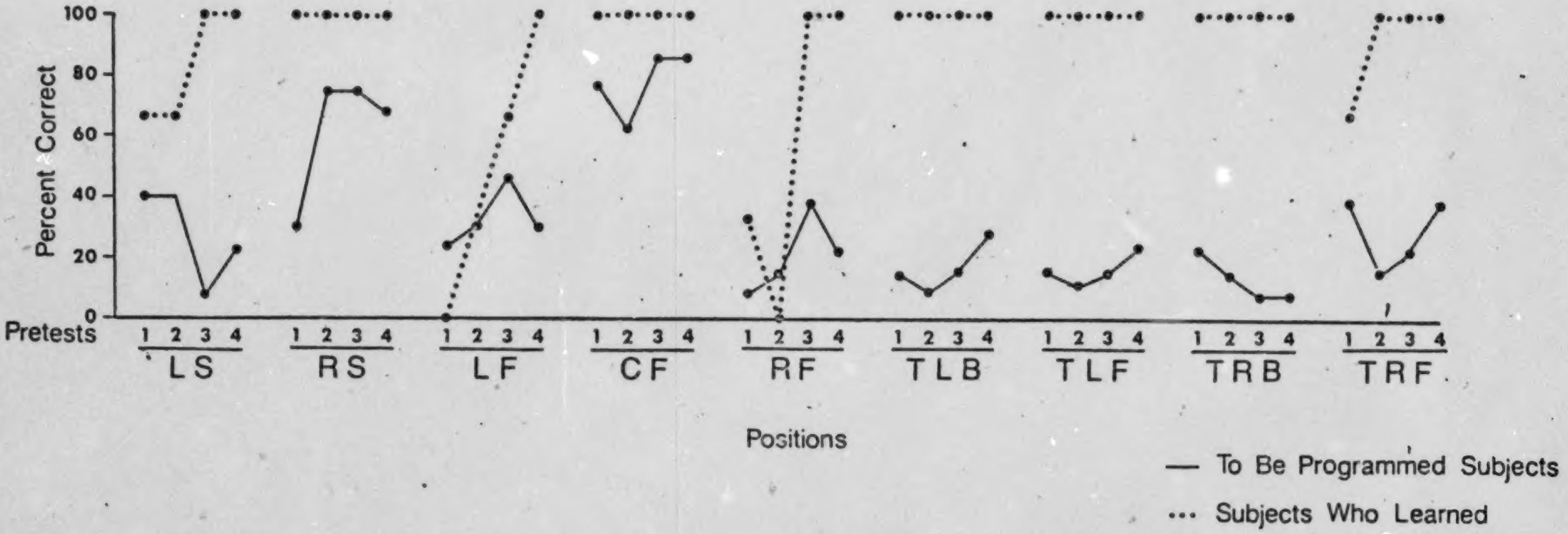


Fig. 17: Comparison of programmed and nonprogrammed (control) sequences for Subject O (Top Right Back) program.

Percent Correct on Pre – Posttest and Intervening Program: Fading in Five Steps with Flashing Light on TRB

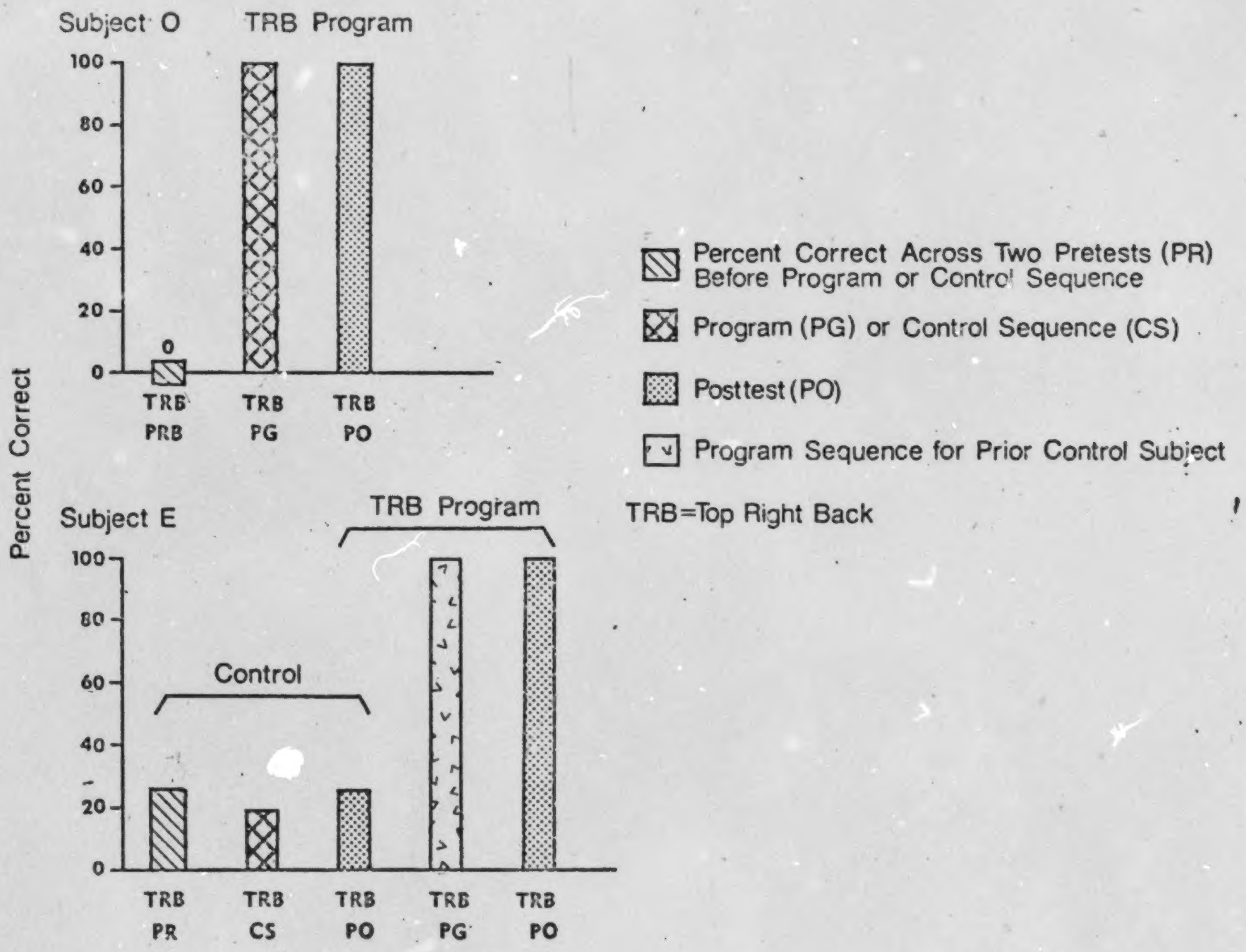


Fig. 18: Percent correct on pre-posttest and intervening programs (Right Front/Center Front, Top Right Back/Top Left Back) for Subject J.

Percent Correct on Pre-Posttest and Intervening Programs.
Program I: Simultaneous Fading of RF and CF Lights in Three Steps;
Program II: Successive Fading of RF and CF Lights in Five Steps;
Program III: Successive Fading of Buzzer (TLB) and Light (TRB) in Six Steps

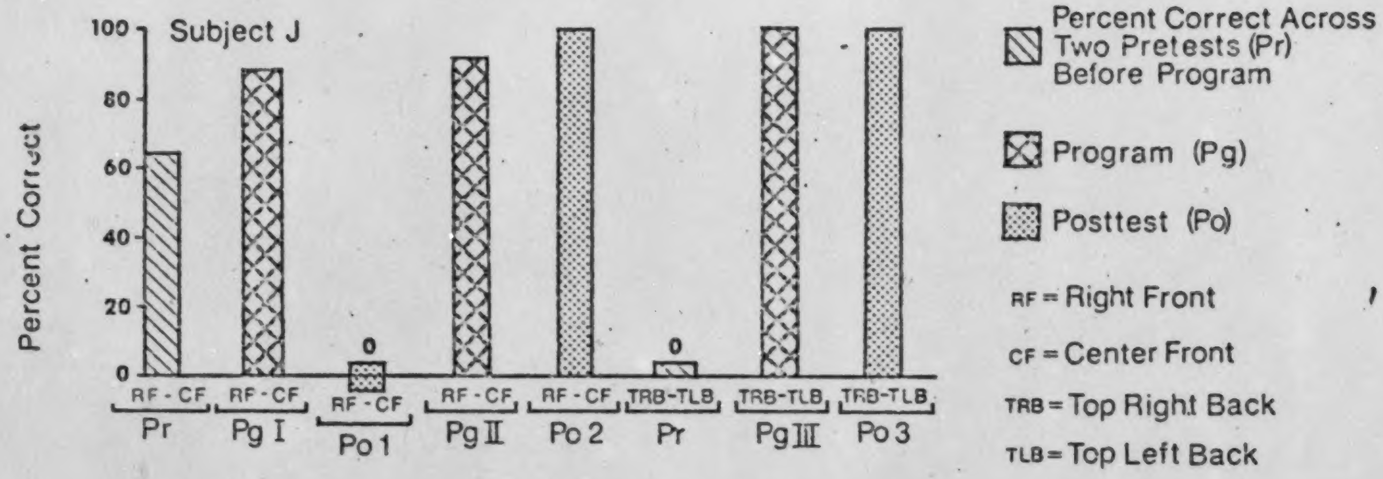


Fig. 19: Comparison of programmed (Left Side/Right Side - Left Front/Right Front) and nonprogrammed (control) sequences for Subject L.

Percent Correct on Pre- and Posttests and Intervening Programs ; Program I : Simultaneous Fading of LS and RS Lights in Three Steps ; Program II : Sucessive Fading of Flashing Light (LS) and Buzzer (RS) in Six Steps ; Program III : Fading of Flashing Light (LS) in Five Steps With Verbal Motor Chain ; Program IV : Fading of Flashing Light (RF) in Four Steps With Verbal Motor Chain on LF

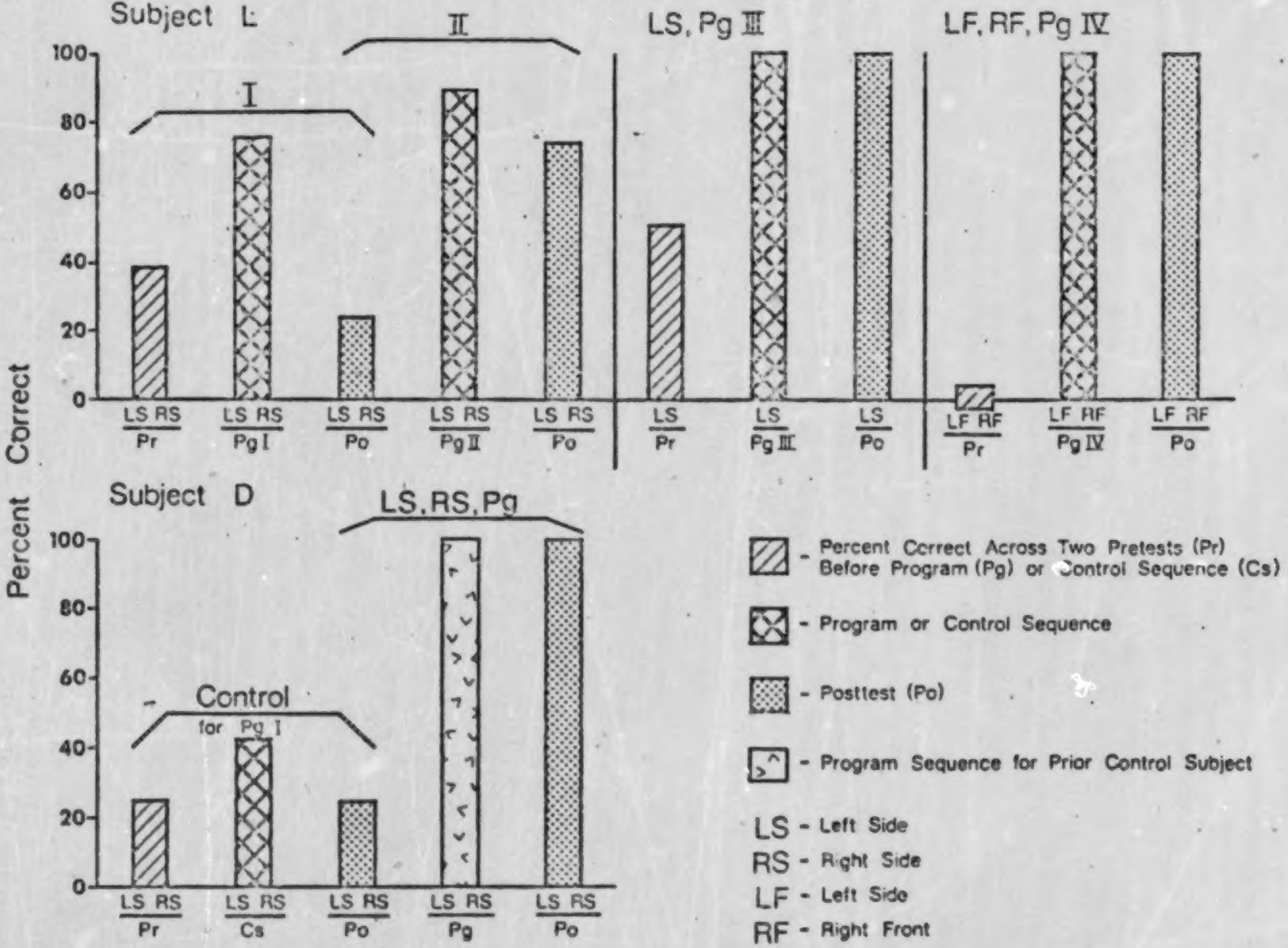


Fig. 20: Comparison of programmed (Left Side/Right Side) and nonprogrammed (control) sequences for Subject I.

Percent Correct on Pre and Posttests and Intervening Program : Sucessive Fading of Buzzer (RS) and Flashing Light (LS) in Five Steps

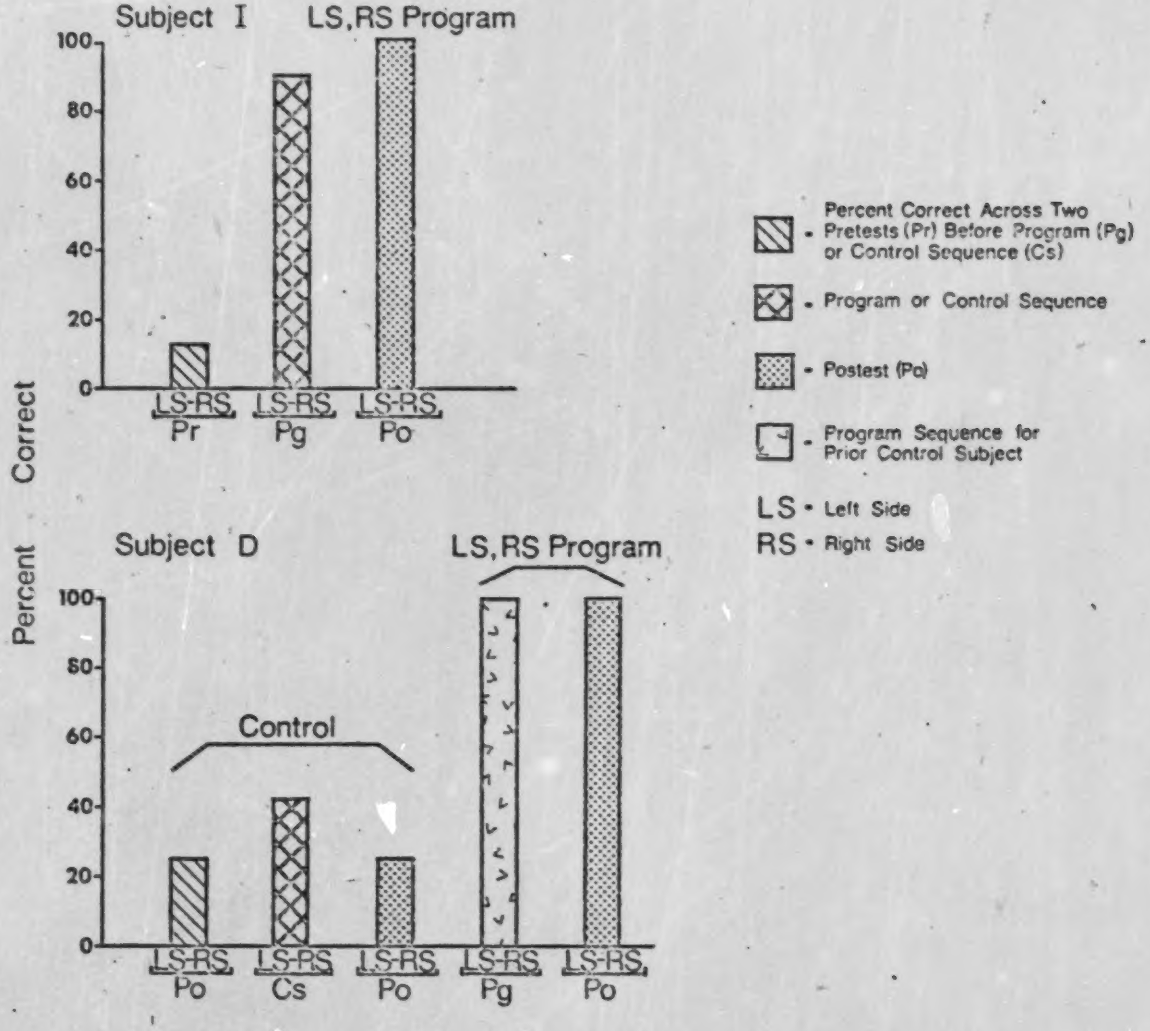


Fig. 21: Comparison of programmed (Top Left/Top Right) and nonprogrammed (control) sequences for Subject H.

Percent Correct on Pre-Posttests and Intervening Program: Successive Fading of Buzzer (TL) and Flashing Light (TR) in Five Steps

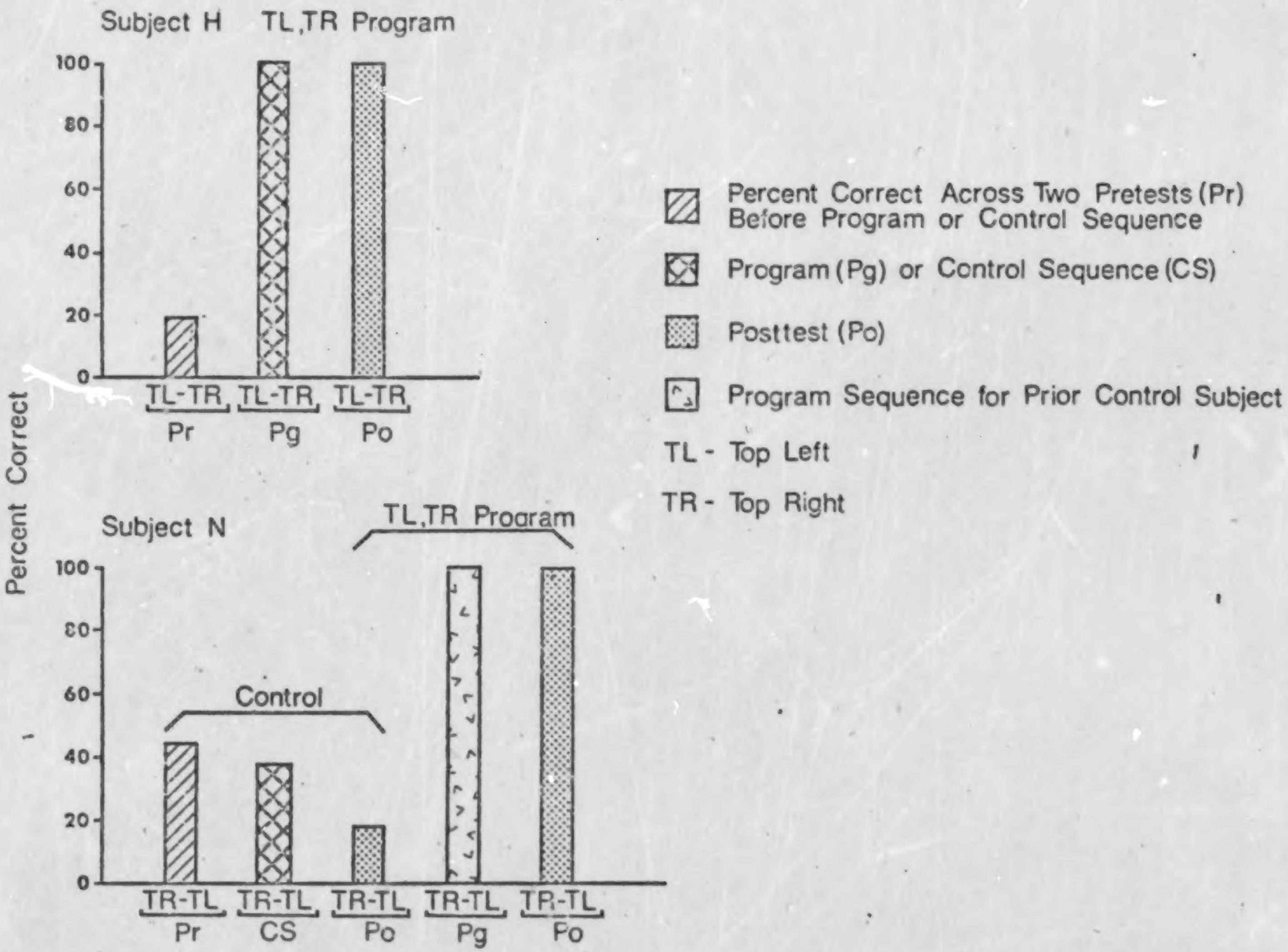


Fig. 22: Comparison of programmed (Left Side/Right Side) and nonprogrammed (control) sequences for Subject A.

Percent Correct on Pre–Posttests and Intervening Program: Successive Fading of Buzzer (LS) and Flashing Light (RS) in Six Steps

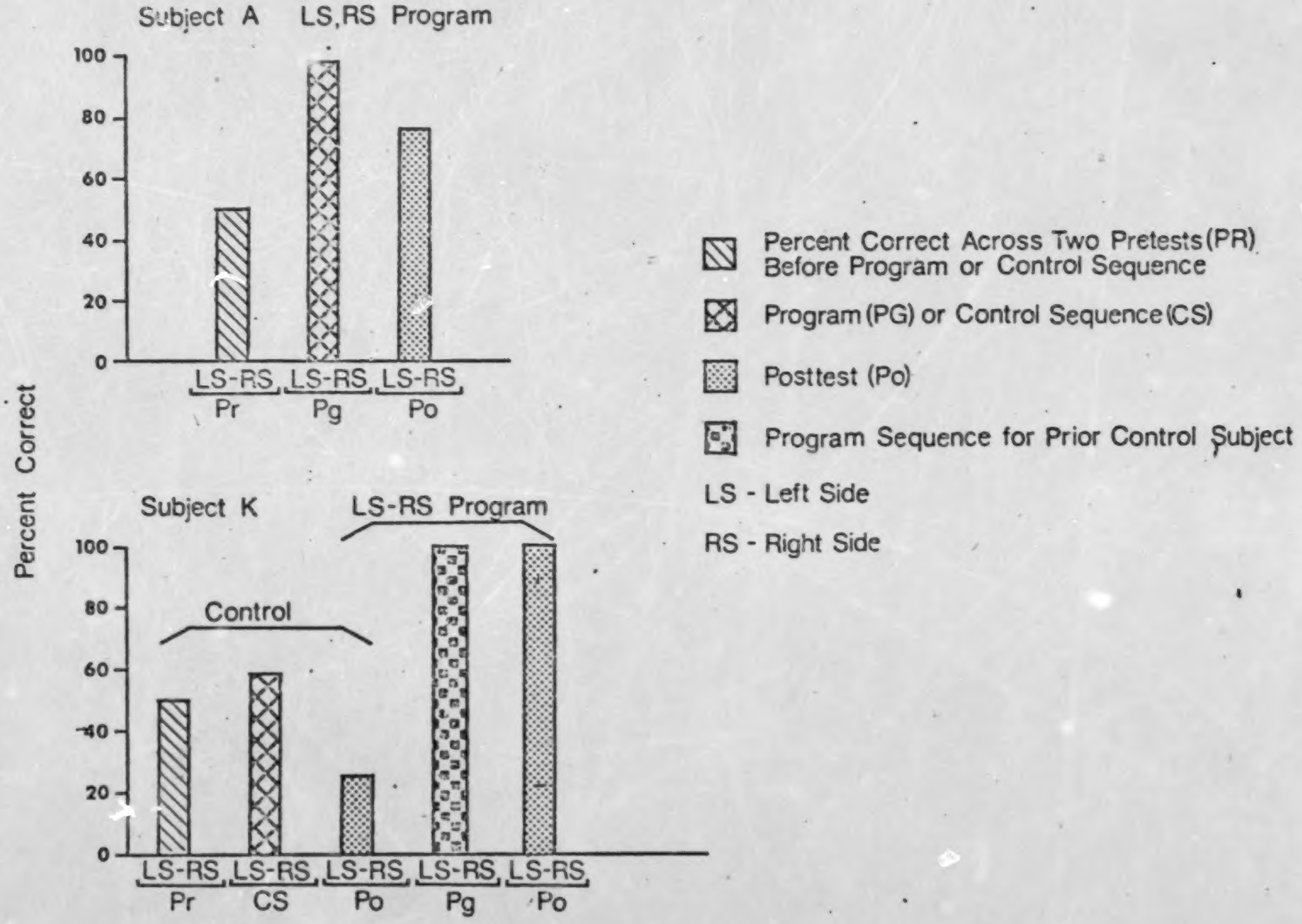


Fig. 23: Percent correct on pre-posttest and intervening program (Left Front/ Right Front) for Subject M.

Percent Correct on Pre-Posttest and Intervening Program: Successive Fading of Buzzer (LF) and Flashing Light (RF) in Seven Steps, with Verbal-Motor Chain

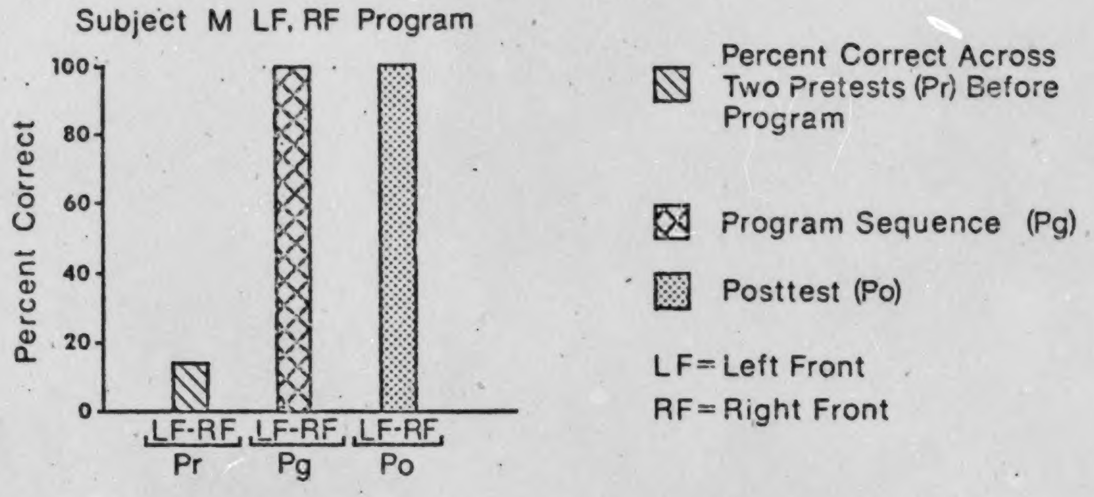


Fig. 24: Percent of increase or decrease of correct responses from pretests to posttests on nonprogrammed stimuli for experimental and control subjects.

Increase or Decrease of Percent Correct Responses
From Pretests to Posttests on Nonprogrammed Stimuli

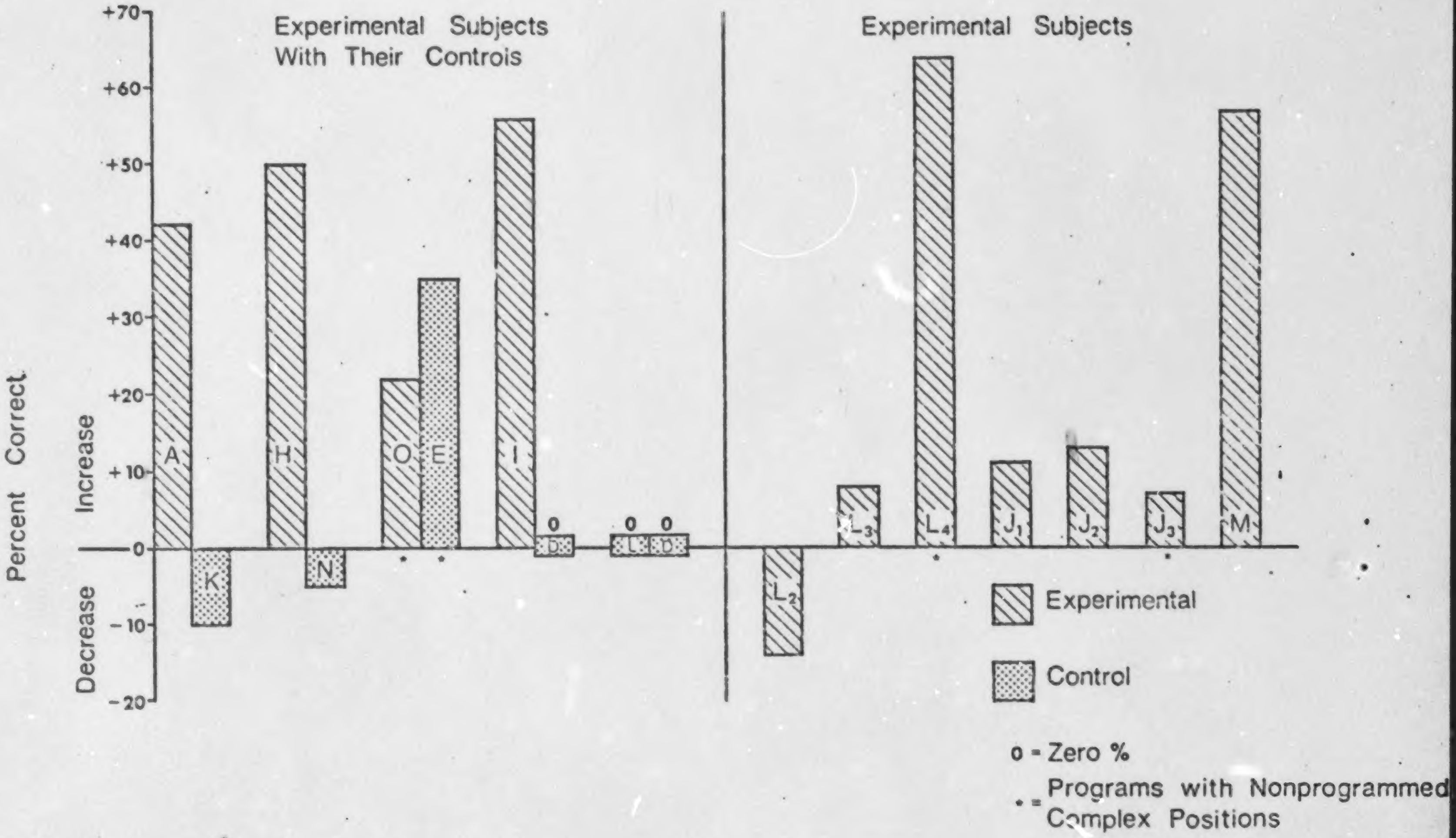
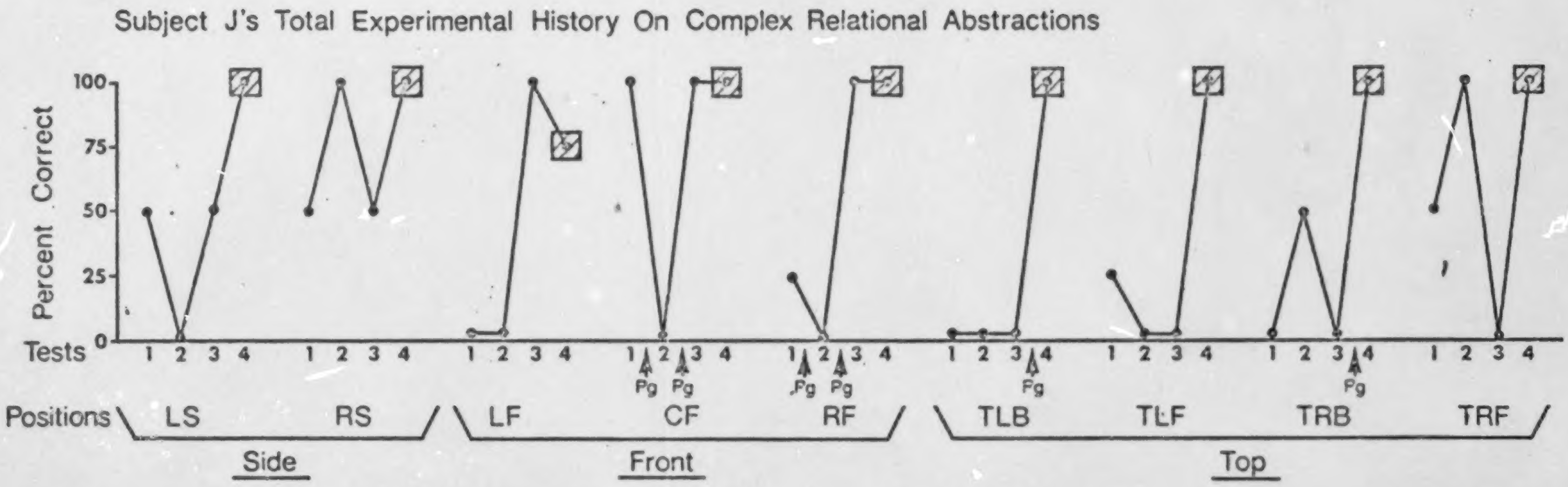


Fig. 25: Total experimental history (nine complex relational positions across four tests with intervening programs) for Subject J.

Percent Correct of Nine Complex Relational Positions Across Four Tests With Intervening Programs



⇑ - Program
LS - Left Side
RS - Right Side
LF - Left Front
CF - Center Front

RF - Right Front
TLB - Top Left Back
TLF - Top Left Front
TRB - Top Right Back
TRF - Top Right Front

▨ Criterion Behavior

Tests : 1 and 4
Had 36 Trials ;
2 and 3 Had
18 Trials

APPENDIX

Simple

Pretest

Subject ______________ Tokens ______________

Experimenter ______________ S^R ______________

Date ______________

	Error Position					
(Front)						
(Under)						
(Behind)						
(Top) RF LF RR LR						
(Side) RS LS						
(Back)						
(Under)						
(Top) RF LF RR LR						
(Behind)						
(Front) RF CF LF						
(Side) RS LS						
(Back)						

Total Number of Responses ______________

Total Number of Correct Responses ______________

Total Number of Errors ______________

Inter-trial Interval Responses ______________

COMPLEX
PRETEST PHASE II

SUBJECT ______________ TOKENS ______________

EXPERIMENTER ______________ S^R ______________

DATE ______________

	ERROR POSITION					
RF						
LS						
TLB						
CF						
TRF						
RS						
TRB						
LF						
TLF						

TOTAL NUMBER OF RESPONSES ______________

TOTAL NUMBER OF CORRECT RESPONSES ______________

TOTAL NUMBER OF ERRORS ______________

INTER-TRIAL INTERVAL RESPONSES ______________

FY 1972

December, 1972

Project:	Studies of Instructional Methods and Techniques in Remedial Reading
Project Code No.:	4B0K08
Principal Investigators:	Montrose M. Wolf Edward R. Christophersen
Contents of this report:	K08-3 Final Progress Report Supervising Paraprofessionals - Performance Related Feedback Remedial Reading: A Program Conducted in an Elementary School Utilizing Paraprofessional Tutors Paraprofessionals Tutoring Reading The Juniper Gardens Reading Program The Juniper Gardens Reading Program: A Manual for Establishing and Maintaining a Remedial Reading Program

KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Project No. 4BOK08

STUDIES OF INSTRUCTIONAL METHODS AND TECHNIQUES IN REMEDIAL READING

Final Report
December, 1972

Principal Investigators

Montrose M. Wolf
University of Kansas

Edward R. Christophersen
University of Kansas

Distribution or quotation of any portion of this paper must be with the permission of the Authors.

Progress Report: Studies of Instructional Methods and Techniques in Remedial Reading

By

Wolf and Christophersen

During the present grant year, the research sponsored by the National Lab has included several areas of emphasis. These include: 1) the development of a supervisory package for monitoring paraprofessional tutors, 2) the evaluation of a new and different set of tutoring materials, 3) an article describing the Juniper Gardens reading program, 4) an article reviewing the use of paraprofessionals to tutor reading, and 5) an unpublished doctoral dissertation conducted at the Juniper Gardens reading program.

1. Supervisory Package

Barnard, Christophersen, and Wolf (1972a, 1972b) described the effects of introducing performance related feedback to the work behavior of paraprofessional reading tutors, in an attempt to maintain these on-the-job performances in the paraprofessional staff. Five paraprofessional tutors served as subjects. Three distinct classes of tutor behavior were examined: 1) completeness of tutoring, 2) accuracy of data sheet calculations, and 3) the time tutoring began each day. A multiple baseline design was employed in which the feedback package was sequentially introduced to dependent variables in a time-series fashion. Changes in the levels of the treated variables were assessed relative to their own baselines, and relative to the concurrent baselines of the untreated variables.

Each day one tutor was randomly selected and a tape recording of one of his tutoring sessions was scored by the experimenter for completeness of tutoring. Also checked were accuracy of the tutor's data sheet calculations for that student and the time the first tutorial session was begun. These results were publicly posted on a feedback display board in the reading lab and in addition, were introduced to the employees personnel folder. The display scoreboard showed the tutor's name, the date, the percentage of student's answers to comprehensive questions correctly tutored, whether the tutor computations of that student's data sheet were found to be with or without errors, and finally, the actual time at which the selected tutor's first tutorial session was begun.

Analysis of the conditions showed that the mean percent with which student's answers were completely tutored increased from a baseline mean of 42 percent to a treatment (or feedback) mean of 93 percent. The percent of errorless data sheets shifted upward from a baseline mean of 62 percent to a feedback mean of 75 percent. The time tutoring began remained unchanged.

Five t-tests were performed to assess the probability with which the observed differences in condition means could be attributed to chance variation. Data were treated as correlated and observations were paired (Dixon and Massey, 1957). Three of these t-tests compared the final eight days of baseline with the first eight days of feedback for each variable. Resultant t-scores showed the condition mean difference to be significant at the .001 level for variable one; significant at the .01 level for variable two; and significant at the .05 level for variable three. Two additional t-tests analyzed the natural variation in the final 16 days of baseline for variables two and three, thus serving as controls for changes occurring in variables one and two. Neither of these t-scores were found to be significant at the .05 level.

These results suggest that the supervisory program was functional in increasing and maintaining two of the three objectively defined tutor work performances to which it was introduced. The complete details of this study are included in Appendix A.

2. Tutoring Materials

Another study (Guntert, 1972) conducted during the present grant year involved an analysis of the effects of a new remedial reading series published by Barnell-Loft, Ltd. called the Specific Skills Series. With this series, seven separate reading skills can reportedly be tutored. The skills chosen for this project were "Following Directions", "Locating the Answer" and "Using the Context". Paraprofessional reading tutors were used in this study to accomplish the tutoring. The tutors utilized previously developed reinforcement contingencies to maintain sentence and answer accuracy.

The evaluation was designed such that the final reading unit from each specific skill composed the test for that skill. In this way, it was possible to test each student's performance in a particular skill before and after tutoring on that skill. In addition to these embedded tests for specific skills, a battery of standardized achievement tests were administered before and after the tutoring.

The complete description of the procedures and results are included in Appendix B. Generally, the standardized achievement test results indicated that using these materials produced results superior to those obtained with the SRA materials utilized in the Reading Program since its inception. The Barnell-Loft series did improve the students' performance when each specific skills was tutored, however, an additional control group using different tutoring materials coupled with the Specific skills tests would be necessary to fully assess the reading improvement. An important conclusion that can be drawn from these results is that the present tutoring program, as developed over the past five years under CEMREL support, is sufficiently well developed to provide a standard for examining tutoring materials.

3. Juniper Gardens Reading Program

An article (Christophersen, Davis and Wolf, 1972) published in Kansas Reading Quarterly, contains a brief discussion of the tutoring program and the results obtained at the reading lab of the Juniper Gardens Children's Project.

A tutoring procedure has been developed which uses commercially available reading materials (SRA Reading Lab Series IIa). The procedure involved instructing the student to read aloud, and subsequently providing differential consequences for the students oral reading accuracy and question answering accuracy.

This program relies on paraprofessional tutors to implement the remedial procedures. These tutors have been either housewives or high school students from the area. We have found they not only made good tutors, but aided in keeping program costs at a minimum.

After less than 15 hours of tutoring, the tutored children showed a mean gain of 1.54 school years on the accuracy componant of the Gilmore Oral Reading Test. The nontutored students gained a mean of .3 school years. In the comprehension section of the same test the tutored subjects gained a mean of .75 school years compared to the non-tutored mean gain of .3 school years.

On the Metropolitan Reading Test, the tutored subjects showed a mean gain of .01 years in Word Knowledge and .5 school years in Reading. The nontutored subjects showed a gain of .03 years and .2 years respectively.

For more details of this study, refer to Appendix C.

4. Paraprofessionals Tutoring Reading

In Lutheran Education a similar article is in press (Christophersen, English, Fischer, Galecki, Larkin and Davis, 1972). The project described in this article was conducted at a parochial school in Kansas City, Kansas. Again, paraprofessional tutors were responsible for the remediation, using the same procedures of instructing the students to read aloud, and providing programmed consequences for oral reading accuracy and question answering performance.

One variable in this study was manipulated--a different set of commericially available reading materials was used (SRA

Comprehensive Reading Series). Results obtained in this study differed from those of the previously mentioned study (Christophersen, Davis and Wolf, 1972) in that after tutoring was completed, the tutored students showed a mean gain of 1.7 school years in oral reading accuracy and 1.6 school years in comprehension (Gilmore Oral Reading Test). The nontutored subjects gained .6 years and lost 1.2 years on the same components, respectively. On the Metropolitan Reading Test, the tutored subjects gained a mean of 1.2 school years in Word Knowledge and .9 years in Reading. The nontutored students made no change in Word Knowledge and gained .6 years in Reading. For more details of this study refer to Appendix D.

5. Unpublished Dissertation

Davis (1972) in an unpublished dissertation, used three sets of relatively similar materials and investigated two reading behaviors while tutoring seven children who had reading deficits. The tutoring procedures were very similar to those previously developed at the Juniper Gardens Childrens' Project (Christophersen, Davis and Wolf, 1971).

In order to assess the dependency of oral reading on question answering accuracy, the experimenter conducted four experiments. Different variables were examined within each experiment. In Experiment 1, both answers and oral reading were scored for accuracy, and the child was instructed to correct any mistakes. Little correlation was found between accurate oral reading and answer accuracy.

In Experiment 2, only the answers were scored for accuracy and the child was instructed to correct any wrong answers. In this case, the rate of correct answers increased.

In Experiment 3, contingencies were placed only on the child's oral reading. That is, reading accuracy was recorded, and reading errors were corrected. In this experiment, the percent of correct answers decreased.

In Experiment 4, a multiple baseline design was employed for each student across the two behaviors: answering questions and oral reading. Each student began by reading and answering questions aloud: no corrections were prompted by the tutor. After several baseline sessions on oral reading, the tutoring procedures were introduced. Similarly after a pre-determined number of sessions, answering questions was then tutored.

In Experiment 4, the oral reading accuracy increased from a baseline mean of 74 percent to a tutored mean of 82 percent. Answer accuracy increased from a baseline mean of 52 percent to a tutored mean of 69 percent. The results of Experiment 4 clearly support the view of oral reading and question-answering as distinct behaviors. Tutoring oral reading did not effect accuracy of answering; only direct tutoring of answering increased the accuracy of answering.

The results obtained in this dissertation suggested that oral reading and answering accuracy are independent. This has clear implications for futher research. Tutoring programs might profitably concentrate on tutoring only specific goal behaviors. Certainly, the research presented here has supported the use of an empirical behavioral approach to field of remedial reading.

Supervising Paraprofessionals-Performance Related Feedback

Barnard, J.D., Christophersen, E.R., Wolf, M.M.
University of Kansas

1972

Accepted for presentation at a symposium American Psychological
Association, Hawaii, 1972

Introduction

Many applied programs are tending toward increased utilization of paraprofessionals (Staats 1970; Ellson 1971). Despite the advantages of increased availability and lesser salaries, the problem of maintaining adequate on-the-job performance with paraprofessionals has been reported (Pierce 1971). In this study of a community recreation center, the satisfactory work performance of paraprofessionals was maintained only under conditions in which pay was contingent upon completion of individual job-components.

Gibbs and Brown (1955), demonstrated the performance of workers operating a document copying machine to be signifigantly increased when feedback on the number of documents copied was provided. In an institutional setting, Panyon, Boozer and Morris (1970) reported improved performances of paraprofessional aids to retarded children, with the introduction of feedback on the number of therapeutic sessions conducted. Leitenberg, Agras and Thompson (1968) reported desired changes in the behavior of patients treated with a technique incorporating feedback components. Several recent studies in educational settings have pointed to the importance of feedback in establishing and maintaining appropriate teacher behavior (Thomas ; Cossairt Thompson, Holmberg and Baer, 1971). Finally, in an industrial setting, Feeney (1971) reports much improved job performance, along with considerable reduction in company expenditures, upon initiating a system to provide workers with knowledge of their daily performance. A comprehensive review of studies dealing with the effects of feedback on human behavior is provided by Annette (1969).

The present study investigated the effects of performance-related feedback on the behavior of paraprofessional reading tutors.

METHOD

Facility:

A remedial reading program served as the setting. The facility housed five small rooms for tutoring, each equipped with a desk; chair; a remotely operated add-subtract point counter; a cassette tape recorder, and stop watch. Tutoring rooms were linked to a master intercom system.

Subjects:

Five paraprofessional reading tutors served as the subjects. Of two adult women, one had completed the sixth grade, and the other one had earned her GED Equivalency diploma. Both had been employed for approximately a year and a half.

Three additional subjects, were high school students, employed through the Neighborhood Youth Corps. These teenagers worked 2 hours per day and had been employed 7 months prior to the study's outset.

Daily Routine:

Tutoring sessions occurred each week-day after school. Reading materials were modified from commerically available SRA reading labs.

While students read stories aloud and answered questions over the materials, tutors monitored their performance, awarding and subtracting points.

Three distinct classes of tutor behavior were examined. They were 1) completness of tutoring, 2) accuracy of data sheet tabulations, and 3) the time tutoring was begun each day.

For complete tutoring, tutors had been trained, and were instructed to emit a short verbal praise statement following each correct answer. A complete tutor after a students' correct answer was thus defined as any audible utterance emitted by the tutor following that correct answer.

Following an incorrect answer, a complete tutor response was defined in terms of 3 components. A tutor emitted verbalization was to occur, which directed the student to refer back to the reading selection, and which prompted the student to physically point-out, or read a question-related bit of information. For example, refer-back prompts usually took the form of "turn back to the story", "look up in the story" and so forth. Point out prompts, in contrast, were defined more specifically, calling for an observable physical response such as "put your finger on sentence 3". A point-out was also said to have occurred whenever a student re-read a sentence aloud.

Recording of complete tutor behaviors was accomplished utilizing a standardized data sheet, scoring each of the response components in an occurrence vs. non-occurrence, fashion.

These data were combined, and expressed in terms of a single-percent complete tutor measure. This measure was obtained by dividing the number of completely tutored answers, by the total number of answers given per session.

Inter-observer reliability of this response measure was assessed by having both trained and naive checkers independently analyze the existing audio-tapes of reading sessions. Periodically, each of 2 regular observers would score the same student's tape. Infrequent naive checker assessments were made, by giving visitors a set of written instructions and the materials for making the check. Naive O records were later compared to those of regular checkers. Reliability of occurrence was assessed throughout, and was obtained by adding agreements between checkers on response occurrence, question by question within each response component column. An overall percent measure of occurrence agreement was then obtained by adding the total number of agreements and dividing by the number of agreements plus disagreements.

II Accuracy of Calculations

Part of each tutor's job entailed tabulating the daily written records of the student's oral reading and question anaswering performance. The accuracy with which these computations were made, was selected as the second dependent variable.

Two products were thus obtained: the students' percent answer accuracy and his percent oral reading accuracy. In order to obtain the students percent answer accuracy the tutor was to count the number of correct answers, divide by the total number of questions answered; round off, and record the resultant on the data sheet. An identical sequence of operations was required in computing percent oral reading accuracy.

Each day, regular checkers retabulated all data sheets, scoring the existing tutor calculations as being with or without errors. To be scored as an errorless sheet each operation had to be correct. Any single error was sufficient to score the sheet as having errors. A standardized re-check sheet was used.

The percent of errorless data sheets served as the second daily performance measure, expressing the number of sheets classed as without error, relative to the total number of data sheets on a given day. Reliability of the measure was assessed by having a second checker independently analyze and rank a day's data sheets. Agreement between checkers was defined as occurring when checkers ranked a sheet similarly. The reliability index was obtained by dividing the no. of agreements on scoring by the number of agreements plus disagreements. Naive checkers provided additional, but infrequent checks of reliability.

III Time Begin Tutor:

The final variable chosen for analysis was the time each tutor began tutoring his first student on a given afternoon. Under normal conditions, daily sessions were to have begun promptly at 3:30 p.m.

The beginning of a reading session was readily identifiable, as students always recited descriptive information aloud, such as name, date, session number etc., prior to reading their first story selection. A session's beginning was defined as the time at which the student began reciting that information.

Because each tutoring room was connected to a master-intercom system, observers had unobtrusive access to this response when it occurred. Regular observers listened for, and recorded start times on a standard data sheet. Digital clocks served as the means by which time of day was measured.

Inter observer agreement was obtained by having a second observer independently record the same responses and time of occurrence. Observations within one minute of each other were required before agreement was credited with occurrence. The number of agreements on time-begin, divided by the number of agreements plus disagreements served as the index of reliability.

From these records', the mean time that all tutors began tutoring was computed.

Design:

A multiple baseline design was employed in which each of the dependent variables was analysed concurrently across all subjects. Compound independent variables were introduced to each dependent variable in a time-series fashion. Changes in the levels of the treated variable were assessed relative to its own baseline, and relative to the concurrent baseline of the untreated variables.

Baseline data were collected over 21 working days. During this time, tutoring occurred unchanged as it had for roughly 18 months. Each day one randomly chosen tape per tutor was analysed in terms of complete tutor. All data sheets were checked for accuracy of calculations, and the session start times were recorded. Feedback on performance on each of these measures was withheld form tutors during baseline.

After 21 days of baseline, a formal meeting of all reading program personnel was held to introduce feedback for complete tutoring. Written hand-outs were distributed, mentioning both the lifting of national wage price controls and the need for objective performance measures by which tutors could be evaluated for pay raises. The decision to select the complete tutor performance measure was announced.

Written definitions of, and instructions for completely tutoring following correct and incorrect answers were provided. As a supplement, a 20 minute video tape was viewed, presenting the most frequently encountered question types, along with the appropriate models of complete tutor behavior for each.

Daily performance was made public each day by means of a 2 ft x 3 ft feedback board, centrally displayed in the reading lab. This "score board" showed the randomly chosen tutor's name, his percent performance scores for each of the complete tutor components, and in addition contained a spot on which the project directors daily signature appeared. Tutor performance scores were also placed in the tutor's personal employee folder.

Feedback Accuracy of Calculations:

Baseline data were collected on the calculation measure for 29 days. On day 30, feedback was introduced to this variable. Tutors were again assembled as a group with written handouts distributed and reviewed. The handout informed tutors that they would receive feedback on this performance through the feedback board. Component operations of the calculation process were also reviewed for the tutors in the handout.

In this second condition, then, the randomly selected tutor not only received feedback on performance on complete tutor, but further, had posted whether that student's data sheet was ranked as being with or without error. This information was also introduced into the tutor's personal employee folder.

Feedback Time Begin Tutor:

Feedback was introduced to the time begin tutor variable on day 38 by calling a third brief group meeting. The time begin tutor variable was introduced as the final tutor performance measure to be monitored and posted on the feedback board. During this condition the randomly chosen tutor was given knowledge of his complete tutor percent scores, whether or not his calculations were done properly, and the actual time he began tutoring his first student on the day in question.

RESULTS AND DISCUSSION

Regular observers checked reliability of complete tutor on 20 separate sessions with a resultant mean percent agreement of 98. Naive complete tutor checkers obtained a mean agreement score of 84 percent. Reliability checks on accuracy of calculations yieled 97 percent agreement between regular checkers and 89 percent between naive O's. Interobserver agreement on time begin tutor averaged 93 percent.

Figure 1 summarizes the mean performance of all 5 tutors on each of the 3 dependent variables measures over 53 session days. Analysis of the condition means shows that the mean percent with which student's answers were completely tutored increased from a baseline mean of 42 percent to a treatment mean of 92 percent. The percent errorless data sheets shifted upward, although in a less pronounced fashion from a baseline mean of 62 to a feedback mean of 76. The time begin tutor variable remained unchanged, with mean time begin averaging 3:42 p.m. during baseline, and 3:42 p.m. under conditions of feedback.

These multiple baseline data suggest a functional relationship between the introduction of the complex of treatment variables and the observed behavioral changes. While it is tempting to attribute these changes to the feedback component alone, such a conclusion would be premature. One cannot point to the feedback display board as having been integral in changing and maintaining performance, as the mention of performance contingent pay raises, for example, may have played an equally important role. The only tenable conclusion would be that this particular combintation of variables effected signifigant positive changes in two of the variables to which it was introduced.

It is important to note that while tutors frequently contacted feedback on their performance via the feedback board, the confounding components of the treatment package were contacted only once-at the manipulation meetings. Equally important, considerable effort was extended to control for the supervisory variables common to most work situations, during feedback conditions. That is, tutors received no feedback on their performance other than what was posted on the feedback board.

These findings add support to the conclusion of Panyon et. al., and Gibbs and Brown, that feedback on performance is a powerful source of behavior control. As witnessed in this study, and as suggested by Annette (1969), the nature of the dependent variable measure to which it is applied, however, may determine both the magnitude and longevity of its control. Important to consider is that the observed behavioral changes reported here were effected very practically. The amount of time required to randomly sample any one tutor, then rate and post his or her performance required only 30 minutes per day. The gains of treatment, however, were signifigant to the extent that the original reading research undertaking could be continued with the assurrance that the proceedures were being reliably performed.

References

Annette, John Feedback and Human Behavior, Baltimore, Maryland, Penguin Books, 1969.

Cossairt, A., Effects of Experiment or Instructions, Feedback and – Social Reinforcement on Teacher Praise and Student Attending Behavior, unpublished master's Thesis, University of Kansas, 1971.

Ellson, D.G., Programmed Tutorial Reading Project, Indianopolis, Indiana, National Center for Educational Communication Document No. 1780-0871, U.S. Government Printing Office, Washington, 1971.

Feeney, E.J. New Tool: Reinforcement for Good Work, Business Week Magazine, December 18, 1971, McGraw Hill, 1972

Gibbs, C.B. and Brown, I.D., Increased Production from the Information incentive in a Repetitive Task, Manager, 1955 *24*, 374.

Leitenberg, H., Agras, W., Thompson, L. and Wright, D., Feedback in Behavior Modification. An Experimental Analysis of Two Phobic Cases, *Journal of Applied Behavior Analysis*, 1968, *2*, 131.

Panyon, M., Boozer, H., and Morris, N., Feedback to attendants as a reinforcers for Applying operant Techniques. *Journal of Applied Behavior Analysis*, 1970, *3*, 1-5.

Pierce, C.

Staats, A.W., Minke, K.A. and Butts, P. A Token Reinforcement Remedial Reading Program Administered by Instructional Technicians, Technical Report No. 127, Wisconsin Research and Development Center for Cognitive Learning, University of Wisconsin, Madison, 1971.

Thomas, D.R., Self-Monitoring as a Technique for Modifying Teaching Behavior (Doctoral Dissertation, University of Illinois at Urbana Champaign Ann Arbor, Michigan, University Microfilms, 1972.

Thompson, C.L., Holmberg, M.C. and Baer, D.M. The Experimental Analysis of Training Proceedures for Preschool Teachers, Paper presented at the Biennial meeting of the Society for Research in Child Development, Minneapolis, 1971.

CHECKER

STUDENT

TUTOR

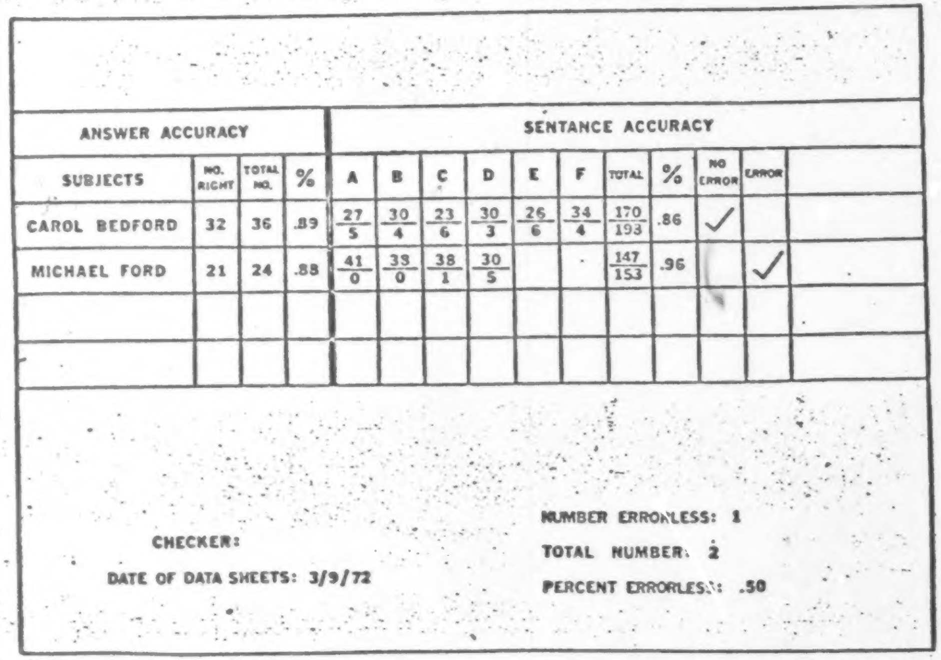
DATE

SESSION

STORY

QUEST	CORRECT ANSWERS				INCORRECT ANSWERS								
	VERBAL CONSEQ		VERBATIM		VERBAL CONSEQ		REFER BACK		POINT OUT		COMPLETE TUTOR		
	YES	NO			YES	NO	YES	NO	YES	NO	YES	NO	
1				1									
				2									
2	✓		"RIGHT"	1									
				2									
3				1	✓		✓		✓		✓		"LOOK BACK... FIND...READ..."
				2									

Complete Tutor Data Sheet



ANSWER ACCURACY				SENTANCE ACCURACY										
SUBJECTS	NO. RIGHT	TOTAL NO.	%	A	B	C	D	E	F	TOTAL	%	NO ERROR	ERROR	
CAROL BEDFORD	32	36	.89	$\frac{27}{5}$	$\frac{30}{4}$	$\frac{23}{6}$	$\frac{30}{3}$	$\frac{26}{6}$	$\frac{34}{4}$	$\frac{170}{193}$	.86	✓		
MICHAEL FORD	21	24	.88	$\frac{41}{0}$	$\frac{33}{0}$	$\frac{38}{1}$	$\frac{30}{5}$			$\frac{147}{153}$	.96		✓	

CHECKER:

DATE OF DATA SHEETS: 3/9/72

NUMBER ERRORLESS: 1

TOTAL NUMBER: 2

PERCENT ERRORLESS: .50

Accuracy of Calculations Data Sheet

DAY ____________
DATE ____________
RECORDER ____________

TUTOR	ROOM	TIME OF ARRIVAL	MINUTES TARDY	TIME BEGIN TUTOR	TIME SCORE	COMMENTS
V. K.	C	2:07	7	3:35	35	
S. P.	D	3:30	0	3:41	41	
B.C.	E					
G.D.	A					
D.W.	B					

Time Begin Tutor Data Sheet

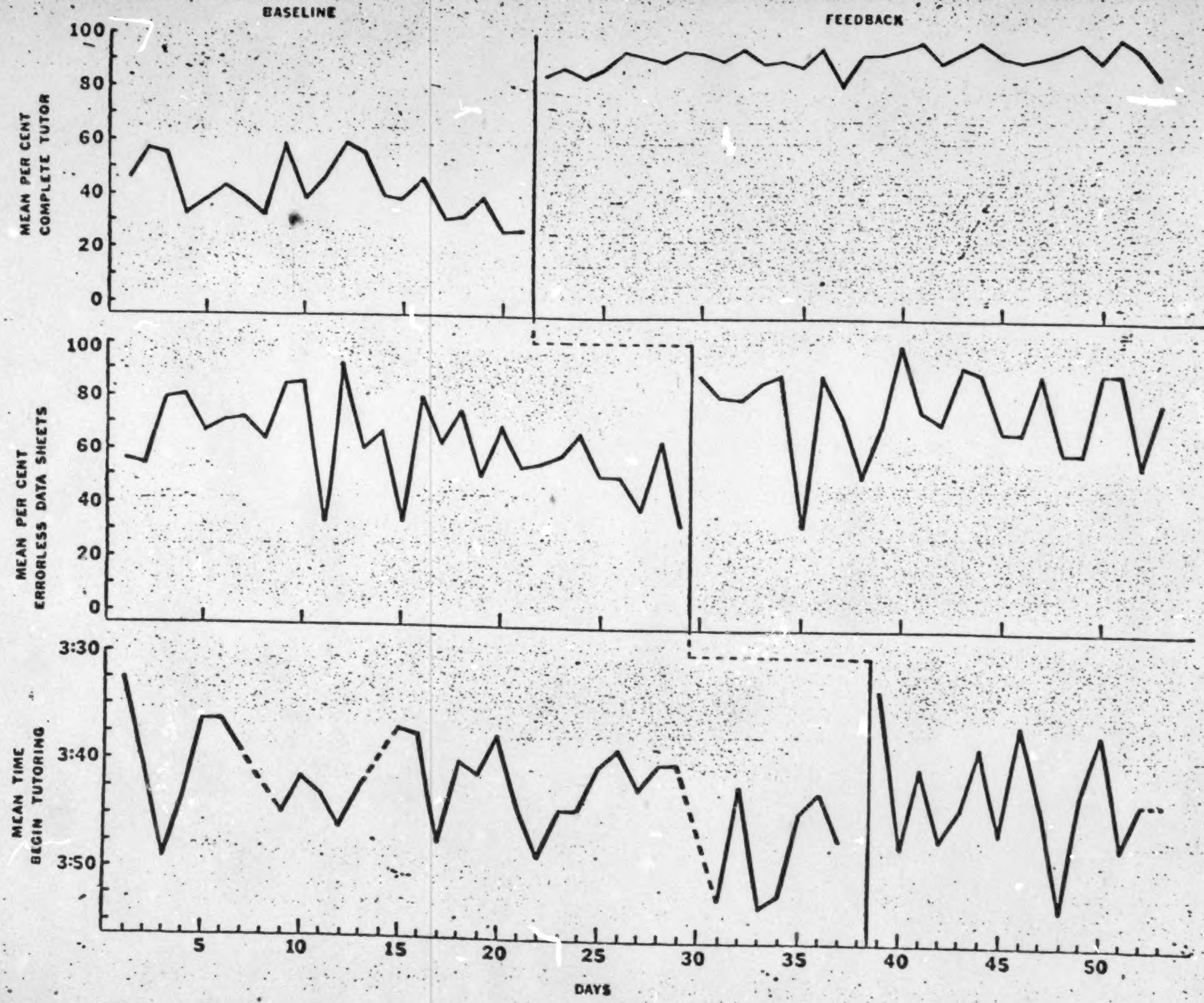


Figure 1 Mean Tutor Performance over Time

Remedial Reading: A Program Conducted in an Elementary School Utilizing Paraprofessional Tutors

Jane C. Guntert
University of Kansas

Introduction

To date, there have been relatively few studies published pertaining to remedial reading that utilize objective data. Christophersen, Davis and Wolf (1970), made a pilot study of an automated remedial reading program. They concluded that a "contingent aloud" condition (the child read aloud and was reinforced for correct answers), produced accurate, low-rate responding. This study indicated that it was possible to exhibit experimental control over local accuracy in a reading situation.

Christophersen, Davis and Wolf (1970) began a remedial reading program utilizing paraprofessional tutors and commercially availiable reading materials (SRA Reading Lab). The students received points contingent upon the correct reading responses. After an average of 14 hours of tutoring, the experimental subjects gained a mean of 1.54 years in oral reading accuracy and gained a mean of 7 months in comprehension. on the Gilmore Oral Reading Test (Gilmore and Gilmore 1968). The control group gained a mean of 3 months in both areas.

In another study, Christophersen, Davis and Wolf (1971) produced even more promising results. The same procedures were used in the study although a different set of materials (SRA Comprehensive Reading Series) was used. After approximately the same amount of remediation (14 hours), the tutored students gained a mean of 1.7 years in oral reading accuracy and 1.6 years in comprehension (Gilmore and Gilmore, op. cit.) The non-tutored students gained a mean of 6 months in accuracy and receded a mean of 1.2 years in comprehension.

In a latest study of Christophersen, Davis and Wolf (in press) the setting was a parochial school in Kansas City, Kansas, and paraprofessional

Undergraduate Honor Thesis

tutors tutored disadvantaged children from the area. The reading materials were the SRA Comprehensive Reading Series again; however, two groups each containing tutored and non-tutored children were examined. In this study the tutored students in group 1 gained a mean of 2.0 years in oral reading accuracy and a mean of 3.3 years in comprehension (Gilmore et.al.) The non-tutored students in group 1 gained nothing in accuracy and gained a mean of 1.6 years in comprehension. In group 2, the tutored students gained 1.4 years in accuracy and 2.0 years in comprehension, while their controls gained nothing in accuracy and gained 9 months in comprehension. (Gilmore et.al.)

The present study is essentially a replication of the one just cited, except that only one group was tutored, and the reading materials were changed.

Methods

Setting

Eight children were chosen by the school principal for tutoring because he felt they were underachieving in school. Six of these children were found to have reading abilities which were equal to or lower than their grade equivalent in school from the achievement tests administered to them at the start of the study. Three of these children were randomly selected to be tutored; the three who were not tutored remained as controls.

Materials:

The reading materials used were the Specific Skills Series by Barnell, Loft, Inc. Example 1 shows level "C" of "Following Directions". The child was instructed to read the directions and the questions. Example 2 shows level "C" of "Locating the Answer". Inorder to show it on one page,

Unit No. 50

DIRECTIONS

This tells how to play Circle Ball. Make a big circle. One player gets in the center. The other players try to hit him with the ball. When the player in the center gets hit, he goes out. The player who threw the ball takes his place in the center. He stays in until he is hit. The game goes on in this way.

---

1. This tells how to play —

(A) Fast Ball
(B) Circle Ball
(C) Wall Ball

---

2. One player gets in the middle of the —

(A) net
(B) circle
(C) wagon

---

3. The other players try to hit him with a —

(A) stick
(B) ball
(C) penny

---

4. If the one in the center is hit, he must —

(A) play football
(B) go out
(C) get in the middle

EXAMPLE 1

Unit No. 25 – SHELTERS EVERYWHERE

(A) Shelters in other countries are often quite different from the shelters in our own country. (B) The houses of far-off lands are sometimes made of strange materials. (C) Sometimes they are built in a different way. (D) They may even be found in places where most of us would never think of living.

(E) In the cold North the Eskimos build their houses out of stone and earth. (F) In the winter when Eskimos go on hunting trips, they make another kind of house. (G) They make it out of snow. (H) It is called an igloo. (I) Snow is the only building material they have in the winter.

(J) People who live in warm countries often make houses out of grass. (K) Grass houses are easy to make and comfortable to live in. (L) Sometimes these grass houses are built on the ground. (M) Sometimes they are built in trees.

Unit No. 25 – QUESTIONS

1. Are shelters in other countries different from ours?
   Sentence (A) (B) (C)

2. Who builds houses out of stone and earth?
   Sentence (C) (D) (E)

3. What is a house of snow called?
   Sentence (F) (G) (H)

4. Are grass houses easy to make?
   Sentence (I) (J) (K)

5. Can grass houses be built in trees?
   Sentence (K) (L) (M)

EXAMPLE 2

the story section and the question page were cut in half. Each story had 10 questions about it.

Example 3 shows level "C" of "Using the Context". The children were instructed to read all of the sentences and then the word choices before filling in the blanks.

In addition, two Panasonic portable cassette tape recorders (model no. RQ-209 das) were used.

Procedures

Each student was removed from his class and taken to a previously designated room in the school which was equipped for the tutoring sessions. The child sat in a desk-chair with the tutor next to him. The tutor remotely operated a counter which was visible to the child, to either add or subtract points. The student was instructed to read all of the material (stories and questions) aloud. In this case, three skills (or workbooks) were being tutored. They were: Following Directions, Locating the Answer and Using the Context.

When the child read a sentence, question, or answer, he was awarded one point. Following each error the child lost three points, and was instructed to correct the mistake. This correction could be in the form of correctly pronouncing a word or sentence, or finding the right answer. After the student had corrected his mistake, he was awarded one point and praised by the tutor. Common examples of tutor praise are: "That is correct", "That's right" and "That's very good." The definition of oral reading errors follower Gilmore and Gilmore (1968) except that hesitations were not counted as errors. That is, mispronounciations, repetitions and omissions of words would be considered as errors. Hesitations were not, in an effort to encourage the sounding out of words.

Unit No. 25

Fish find the strangest places to hide. One small fish swims right into his mother's mouth! Out he (1) .... when the danger has (2) ....

1. (a) cooks (b) rings (c) comes (d) reads

2. (a) passed (b) take (c) toys (d) step

A cat will often find its way home from a great distance. One cat traveled two hundred miles to come (3) .... to its owner. Cats have a good sense of (4) ....

3. (a) send (b) write (c) back (d) away

4. (a) rain (b) sat (c) direction (d) money

Toy soldiers have been the playthings of children for many years. Long, long ago toy soldiers were (5) .... in armor just like the (6) .... soldiers of that time.

5. (a) let (b) dressed (c) side (d) last

6. (a) real (b) cat (c) cookie (d) hungry

Did you know that your name means something? Alice means "truth," Peter means "a rock," and Charles means "strong." Find out what your (7) .... means. Ask your (8) ....

7. (a) house (b) toy (c) look (d) name

8. (a) pet (b) wagon (c) teacher (d) cow

An ant can lift things fifty times its own weight. If you could lift something fifty times your weight, you could lift a car. The ant may be (9) .... , but he is very (10) ....

9. (a) tall (b) fat (c) fast (d) small

10. (a) lost (b) snow (c) strong (d) hide

EXAMPLE 3

While the tutor was listening to the child read and awarding or penalizing points she was also making a permanent record of the child's reading. That is, on a specific form, she marked whether each sentence was read correctly or incorrectly. This sheet was used later to compute the child's sentence accuracy for the day. (See Example 4)

The child was given an answer sheet at the start of each session. The accuracy of his written answers was also computed. (See Example 5) This and the sentence sheet were then placed in the child's folder. If the child averaged atleast 83% accuracy for three consecutive days, he was advanced to the next level in difficulty in the workbooks. This was based on the assumption that if the child maintained a high percent (above 83%) of answer accuracy, he could be considered competent in that level and ready to move on to a more difficult level. Once a week the supervisor charted the data on a graph as a measure of the child's progress.

Each day the student was tutored for approximately 20 minutes. Immediately after the tutoring the child could exchange his points for money. The rate of points to pennies varied with each skill depending upon the level of difficulty. For example, during the tutoring of "Following Directions", all the children were able to read more (8-10 pages) than they could during "Locating the Answer" (1-1½ pages). In order to keep the child's earnings consistant through the study, it was necessary to change the ratio of points to pennies. During "Following Directions" the ratio was 4 points/penny. During the remaining two workbooks the ratio was 3 points/penny. On the average, the children earned between twenty and fifty cents daily.

udent Mike Date 12-8-71 Session 20

otal Sent. 15 Sent. Corr. 13 % Corr. 86%

age No.

16 ① ② ③ ④ ⑤ ⑥ ~~7~~ ~~8~~ ⑨ ⑩ ~~11~~ ⑫ ⑬ ⑭ ⑮
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

_______ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

/ indicates an incorrectly read sentence

○ indicates a correctly read sentence

EXAMPLE 4

[illegible]

Date 12-8-71 Session 20

Start: Book Page 16 Question

Stop: Book Page 17 Question

Page 16

1. A
2. B
3. E
4. G H
5. K
6. M
7. O P
8. R
9. T
10. X
11.
12.

Page

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Page

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Page

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Page

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Page

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

INCORRECT 2 # CORRECT 8 # TOTAL 10 % CORRECT 80% [illegible]

Each student was tutored for 27-29 sessions; this amounted to 10 hours of remediation. Since there were three skills being tutored, we tutored the student for approximately 9 sessions on each skill.

Testing

Before any remediation was begun, each student was given a battery of tests. The tests consisted of: the California Achievement Test (form W), the Gilmore Oral Reading Test (form C), and a test the experimenter composed from the workbooks. Since there were six levels in each of the three workbooks, we chose one unit (#47) from each level of the three workbooks for the pre-test. The scores from these tests were then averaged for each group. A comparison of the tutored and non-tutored groups could be made to assess the improvement of each. The scores from these skills tests also determined the level of difficulty that the child would begin in the next tutoring skill. For example, if the child scored 100, 100, 100, 75, 75, 60 on the test levels A-F respectively, he would be started on level "C" for that skill.

After "Following Directions was completed, all six students were given another skills test--this test was composed of all units #48. After "Locating the Answer" was completed, all six students were given a skills test composed of all units #49.

After "Using the Context" was completed, all six students were given a skills test composed of all the last units (#50) in addition to the California Achievement Test (form X) and the Gilmore Oral Reading Test (form D). The differences in these scores determined how much the children in each group improved, and which group made the most significant changes.

Results

There were 22 reliability checks done on interobserver reliability. The percentage of agreement ranged between 80 and 100% with a mean of 94%. The tutors performed the checks daily after the tutoring was completed. The checks consisted of listening to the tape, and scoring the sentence accuracy of the child as if the listener were the tutor. That is, if the listener thought the sentence was read correctly, it would be scored as correct on a separate sentence accuracy sheet regardless of how the tutor reacted to the sentence. The reliabilities consisted of scoring only the the sentences that the child read; no answers were included. Approximately 38% of the sessions were chosen for reliability checks. Reliability was computed by dividing the number of aggreements by the number of agreements plus disagreements and multiplying by 100.

The first subject, Mike, was in the fourth grade. He was believed to be underachieving in class; however, his pre-test achievement test scores were very good. He tested at grade level 4.2 on both componants of the Gilmore Oral Reading Test and at 6.0 years on the "Total" score of the California Achievement Test. According to the data presented in Figure 1, Mike's mean percent of answer accuracy was 78%. Under each workbook, the mean percent of answer accuracy was: 88% for Following Directions, 64% for Locating the Answer and 82% for Using the Context. According to the data presented in Figure 2, Mike's mean percent of overall sentence accuracy was 93%. His sentence accuracy in the workbooks was: 97% for Following Directions, 84% for Locating the Answer and 97% for Using the Context.

The second subject, Barbara, was in the eighth grade. She was selected for the program because her reading abilities were so poor; on a pre-test

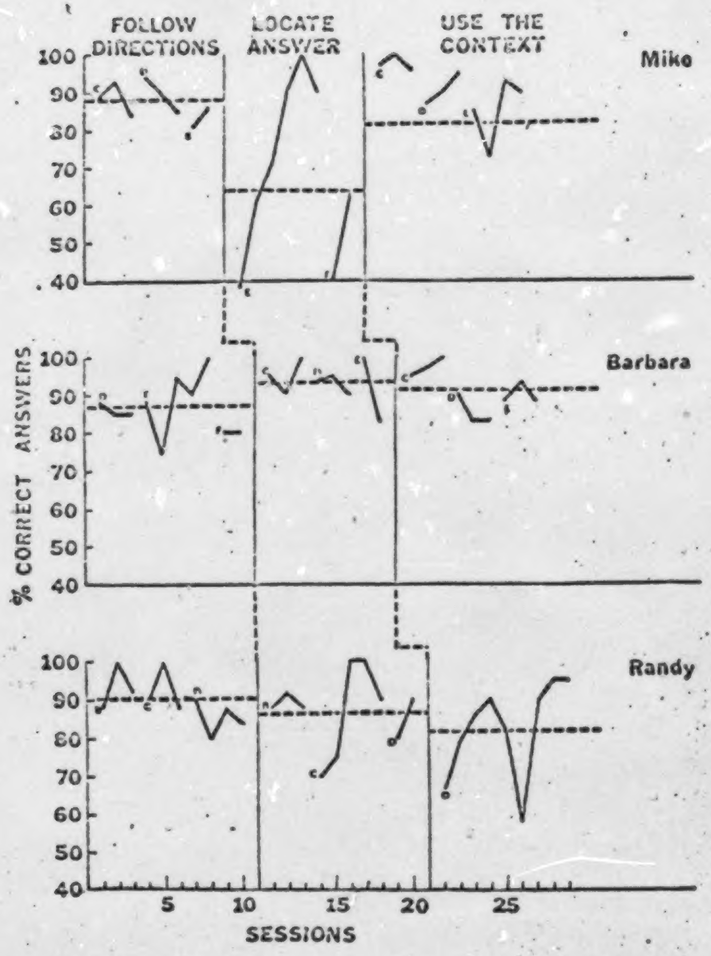

FOLLOW DIRECTIONS
LOCATE ANSWER
USE THE CONTEXT
Mike
Barbara
Randy
% CORRECT ANSWERS
100
90
80
70
60
50
40
5
10
15
20
25
SESSIONS

figure 1

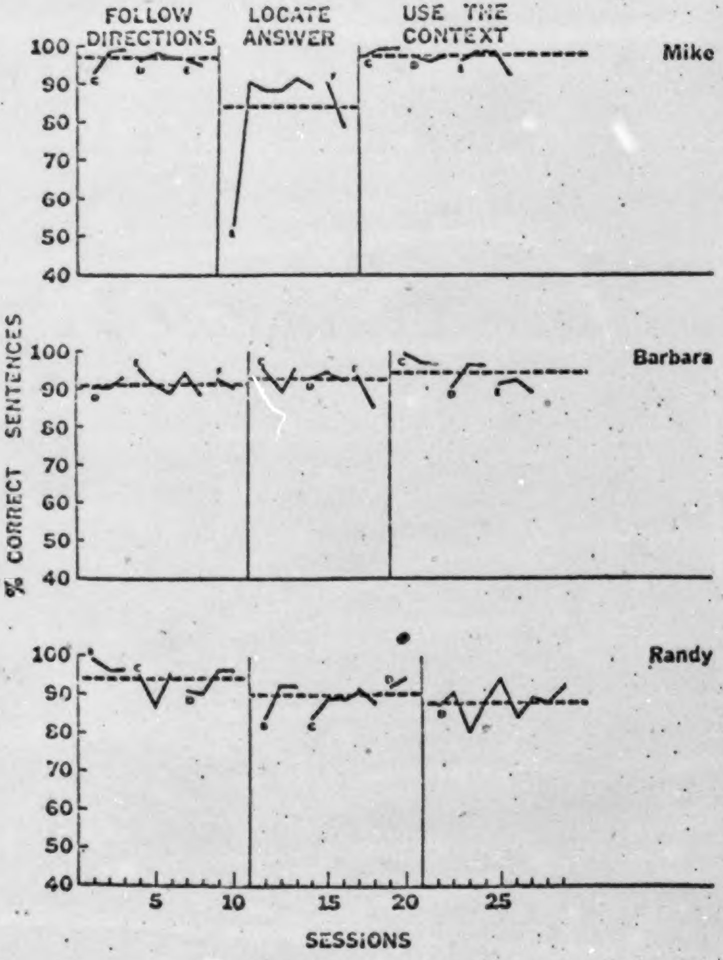

FOLLOW DIRECTIONS
LOCATE ANSWER
USE THE CONTEXT
Mike
Barbara
Randy
% CORRECT SENTENCES
100
90
80
70
60
50
40
5
10
15
20
25
SESSIONS

figure 2

of the Gilmore Oral Reading Test, she scored a grade equivalency of 2.9 years on accuracy and 3.8 years on comprehension.

Barbara had the highest answer accuracy of the group, with a mean of 90%. According to Figure 1, on the individual workbooks she maintained a high level of answer accuracy with a mean of 87% for Following Directions, 93% for Locating the Answer and 91% for Using the Context. According to Figure 2, her mean percent of sentence accuracy was 91% for Following Directions, 92% for Locating the Answer and 94% for Using the Context. Barbara maintained an overall mean of 92% for sentence accuracy.

The last subject was Randy, a fifth grade boy. He had been enrolled in a similar reading program during the previous summer, but had a very poor attendance record. Although the experimenter had a little difficulty in getting Randy to come for the tutoring, his attendance during this study was flawless.

Figure 1 indicates that Randy's answer accuracy had a mean percent of 87%. Under the separate workbooks, his answer accuracy for Following Directions, Locating the Answer and Using the Context had a mean percent of 90%, 87%, and 82% respectively. Figure 2 represents Randy's means of sentence accuracy, which were 94%, 90% and 88% respectively. Randy's overall mean of sentence accuracy was 91%.

All three children maintained a high level of accuracy on answers and sentences. On particular tutoring sessions the accuracy may have fallen, but in only one instance was a child's mean percent of accuracy below 82%.

A comparison of the skills tests scores between the tutored and non-tutored subjects is shown in Table I. The test scores in boxes

Insert Table I here

are those test scores which show any increase in the scores of the tutored subjects after tutoring on that particular workbook had ceased. After tutoring on Following Directions was completed, the tutored group had a mean score that was 18 points higher than the control group. After Locating the Answer was finished, the experimental group tested an average of 13 points above the control group. Finally, after tutoring Using the Context, the tutored subjects' scores averaged 17 points higher than than the controls. These scores are focused on in Table II, below.

Insert Table II here

As Table III indicates, the tutored subjects improved 2.8 years over their controls on the accuracy componant of the Gilmore Oral Reading Test. Less significant are the comparisons of the California Achievement Test scores. While the experimental subjects made no noticeable changes, the control subjects' scores also remained somewhat constant on the "Total" score. The T-test, a test for the statistical significance of the results, proved them to be "not significant".

Insert Table III here

Discussion

In comparison with the results yielded from previous studies, the present research indicates an increase of atleast one year over any of the previous research (Christopherson, et.al., 1970, 1970, 1971). Pinpointing why the gains were so much higher is difficult. There are many influences we may rule out, but there is still no definite answer. The

Table I

Mean Percent Correct on Skills Tests

	Tutored			Non-tutored		
	Follow Directions	Locate Answer	Using Context	Follow Directions	Locate Answer	Using Context
Pre-test	88	74	80	88	53	67
Test I	$\boxed{91}$	79	58	$\boxed{63}$	67	62
Test II	94	$\boxed{58}$	81	76	$\boxed{45}$	54
Post-test	92	61	$\boxed{87}$	62	51	$\boxed{50}$

Table II

Comparison of Mean Test Scores After Specific Tutoring

[illegible]	Tutored	Non-tutored
Follow Directions	91	63
Locating the Answer	58	45
Using the Context	87	50

Table III

Mean Gain in Years
Pre- to Post-test Scores

	Tutored	Non-tutored	T
California Achievement Test			
Vocabulary	+ .1	+1.1	ns
Comprehension	- .3	- .4	ns
Total	- .5	+,.06	ns
Gilmore			
Accuracy	+3.4	+ .6	
Comprehension	+1.8	+1.5	

tutoring procedures were exactly the same as in previous research. The setting was also the same, and the tutors seemed to perform equally well. This leaves two variables: the reading materials and the subjects we selected. The only way to eliminate one or both of these variables would be to replicate the study using different subjects and the same materials.

There are also four other skills in the Barnell, Loft series that we did not tutor. They are: Getting the Facts, Working with Sounds, Drawing Conclusions and Getting the Main Idea. These skills, combined with some that were tutored, or left alone, could also produce interesting results.

In the skills tests given intermittently during the tutoring, the tutored subjects scored significantly higher than their controls. This verifies that the tutoring had some effect on the learning of those skills.

The California Achievement Test scores are slightly lower, though not significantly, than in previous research. The T-tests proved these gains were not significant. However, it is exceedingly difficult to get statistical significance with only three subjects in each group.

There are at least two variables which we could manipulate for further research, in addition to those already mentioned. One is the length of time spent on each skill. Ten or fewer sessions equals approximately three hours of remediation. Considering the results obtained after such a short period of time, increasing the number of sessions per skill could conceivably have a profound effect upon the testing results.

As a plan for furhter research, I would suggest (a) keeping the same skills and lengthening the number of sessions per skill to 20 sessions or until the end of level"F" is reached, and (b) changing one skill, for example Using the Context to Getting the Main Idea or Finding the Facts while keeping all other conditions constant. By following systematic replications (Sidman, 1960) of the study, it will be possible to find which combinations produce the most effective remediation.

Footnotes

This research was supported by a grant from the University General Research Fund (3806-6706), through Dr. E.R.Christophersen.

Programs of this nature are impossible without the active support of school principals like Mr. Paul Wolters, Lutheran Church of Our Savior School, Kansas City, Kansas.

The author wishes to thank Drs. E.R.Christophersen and M.M. Wolf for their guidance and Susan K. Raney for her assistance.

References

Christophersen, E.R., Davis, M.J., and Wolf, M.M. An experimental analysis of local accuracy in an automated reading program for disadvantaged children. Presented at: American Psychological Association, Miami, 1970.

Christophersen, E.R., Davis, M.J., and Wolf, M.M. Paraprofessionals tutoring reading. Submitted to: Lutheran Education, April, 1971.

Christophersen, E.R., Davis, M.J., and Wolf, M.M. The Juniper Gardens reading program. Unpublished Manuscript.

Christophersen, E.R., Davis, M.J. and Wolf, M.M. A tutoring program utilizing paraprofessional tutors. Unpublished Manuscript.

Gilmore, J.V., and Gilmore, E.C., Gilmore Oral Reading Test. New York: Harcourt, Brace, Jovanovich, 1968.

Sidman, Murray. Tactics of scientific research. New York: Basic Books, 1960.

Paraprofessionals Tutoring Reading[1]

Edward R. Christophersen, Kathryn S. English, Katherine A. Fischer
Gwynne L. Galecki, Joan A. Larkin, and Michael J. Davis

The reading ability of elementary school children is a topic of great concern today. Researchers and educators are confronted with a two-fold problem: structure early childhood education so as to maximize each child's reading skills and provide effective remedial techniques for those children who have already acquired substantial reading deficits. We have chosen to carry out research on this second alternative -- remedial techniques -- and for our student population we have gone to the Lutheran Church of Our Savior School in Kansas City, Kansas. A central problem here -- that of defining adequate reading performance -- has been vigorously approached by the reading achievement test constructors. The assessment of a given child's reading performance is usually done with these achievement tests. The design of an effective remedial reading program might profitably be directed at improving skills defined by the achievement test as important.

Two skills which are common to the achievement test situation, to the classroom, and to a variety of tutorial situations are answering multiple-choice questions following paragraph reading materials and oral reading. A tutoring procedure has been developed (Christophersen, Davis and Wolf, 1970, 1971), using commercially available reading materials (SRA Comprehensive Reading Series), which maintains the accuracy of an individual student's multiple-choice answers while he progresses through increasingly more difficult reading materials.

Submitted to: Lutheran Education, April, 1971

Tutoring Procedures

Each student is seated in a small room in front of a desk upon which a counter is mounted. The tutor can remotely operate the counter to either add or subtract points. Student are required to read all of the materials (stories and questions) aloud. Following each correctly read sentence, a point is added to the student's counter. Following each error, three points are subtracted, the tutor indicates and corrects the error, and the student is instructed to repeat the sentence. Definition of oral reading errors follows Gilmore and Gilmore (1968) except that hesitations are not counted as errors.

Following the correct reading of a question and answers the student writes an answer. Following each correct answer, a point is added to the counter, and the student is advanced to a new question or story. Following each incorrect answer, three points are subtracted, and the student is instructed to answer the question again.

Each day, each student is tutored for approximately 20 minutes. Following the tutoring the student exchanges his points for money at the rate of one cent for each point.

Tutors

This program relies on paraprofessional tutors to do all of the remediation. These tutors have all been junior and senior nursing students from the University of Kansas Medical Center. Training the tutors is an essential part of the program. The tutors are first instructed in the use of the materials and they are given practice in seating the student, preparing answer sheets, and checking answers. They are then given definitions of the various types of oral reading errors. When they understand how to mark the record sheets, they practice tutoring in a role playing situation, with an experienced tutor acting as a student. Finally, they begin tutoring students under close supervision; as they improve, they are supervised more intermittently. So far, each new tutor has been able to tutor correctly after only a few hours of training and close supervision. These tutors can use the procedures and materials very effectively to maintain accurate oral reading and answering of questions by the student. An extremely important aspect of this program was the inclusion of occasional reliability checks. Each time that a student was tutored a tape recording was made. A second tutor listened to the tape recording and recorded the accuracy of oral reading. Agreement on the accuracy of oral reading was then determined between the data from the original tutoring and the data gathered from the tape recording, to provide an indication of the reliability of the tutoring.

Testing

Since it is important that the reading improvement be evident outside the tutoring room as well, we also measured the students' reading with standardized reading achievement tests.

We administered a battery of tests prior to and following 12 weeks of tutoring. At the same times we tested non-tutored students. Our battery included the Gilmore Oral Reading Test and the Metropolitan Reading Test. As Table 1 shows, the results were quite promising. On all tests the tutored students improved more than the non-tutored students.

TABLE 1

Mean Gain in Years

Pretest to Post test

Test	Tutored	Nontutored
Gilmore Oral		
Accuracy	+ 1.7	+ .6
Comprehension	+ 1.6	-1.2
Metropolitan		
Word Knowledge	+ 1.2	-0-
Reading	+ .9	+ .6

Perhaps as important as any of our other results to date is our discovery that paraprofessionals, with little training, can be effective tutors. In a similar program that we are conducting in a low income area of Kansas City, we are using high school students, in the Neighborhood Youth Corps program, as tutors. The use of paraprofessionals as tutors provides an effective method which is practical in terms of professional time and program expense.

Footnote

[1] This research was supported by grants from the National Coordinating Center, National Program on Early Childhood Education (OEC-3-7-070706-3118) and from the National Institute for Child Health and Human Development (HD 03144-03), and Public Health Service (NU-00312).

Programs of this nature are impossible without the active support of school principals like Mr. Paul Walters, Lutheran Church of Our Savior School, Kansas City, Kansas.

References

Christophersen, E.R., Davis, M.J. and Wolf, M.M. An experimental analysis of local accuracy in an automated reading program for disadvantaged children. Presented at: American Psychological Association, Miami, 1970.

Christophersen, E.R., Davis, M.J. and Wolf, M.M. An experimental reading program using paraprofessional tutors. Accepted for presentation at; American Psychological Association, Washington, D.C., September, 1971.

Gilmore, J.V. and Gilmore, E.C. Gilmore Oral Reading Test. New York: Harcourt, Brace & World, Inc. 1968.

The Juniper Gardens Reading Program: A manual for establishing and maintaining a remedial reading program.

Montrose M. Wolf and Edward R. Christophersen

Prepared by the section on Studies of Instructional Methods and Techniques in Remedial Reading, Kansas Center for Research on Early Childhood Education, National Program on Early Childhood Education

November 1972

Preliminary Draft. Not for reproduction, referencing or citation

Published by CEMREL, Inc., a private nonprofit corporation supported in part as an educational laboratory by fund from the National Institute of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the National Institute of Education, and no official endorsement should be inferred.

Copyright on these materials is claimed only during the period of development, test and evaluation, unless additional authorization is granted by the National Institute of Education to claim copyright on the final materials. For information on the status of the copyright claim, contact either the copyright proprietor or the National Institute of Education.

Copyright © 1972, CEMREL, Inc.

10646 St. Charles Rock Road
St. Ann, Missouri 63074
314/429-3535

A. Introduction

This manual is a complete description of the techniques and procedures for establishing and maintaining a remedial reading program patterned after the Juniper Gardens Reading Program. The procedures were originally developed in a program in a low income federal housing project (primarily blacks), but have since been replicated at the University of Kansas Medical Center, Children's Rehabilitation Unit, and at the Lutheran Church of Our Savior School in Kansas City, Kansas. Additional preliminary work was conducted at Grant Elementary School in Kansas City, Kansas.

Many individuals have contributed to the development of this manual including James D. Barnard, Jane Guntert, Mary Ann Mitchell, Susan K. Rainey, and Carolyn M. Voss. Without their contributions this manual surely would never have been completed.

B. Setting

The reading program should be carried out in a relatively quiet area. Because the program aims at improving reading skills, the area must allow the child to concentrate on what he is doing. For this reason it is necessary to separate the tutor and child from other tutoring couples.

Separating the tutoring couples may present a problem for accurate supervision. It would help greatly to have the area equipped with a monitoring system such as an intercom or one way mirrors. It is essential that the supervisor be able to hear how the tutoring is being done. Tape recorders, if available, can also be used. If none of these are possible, simply keep the tutoring areas or rooms large enough for the supervisor to be present during the tutoring sessions.

Within the designated tutoring area, a table and chair should be provided for child and tutor. An oversized clipboard large enough to hold the reading material on one side and papers (oral reading sheets) on the other side may be used by the tutor. If a tape recorder is to be used, electrical outlets and a place to set the recorder and microphone should be near by.

The number of tutoring areas or rooms needed will depend on the number of tutors. Each tutor should have his or her own area. A central work area, where materials can be kept, is also useful for dispersing reinforcements and as a work area for the tutors when calculating percentages. If possible this room should be separate from the tutoring areas. It is also advisable to have a separate room where children waiting to be tutored will not disturb those who are being tutored.

C. Selection of Materials

Since this program deals with improving the two skills, oral reading and comprehension (i.e. question answering), any materials used must include; 1) material (stories) that can be read aloud and 2) questions concerning the material. Standardized reading materials such as the SRA reading lab kits are perhaps the easiest to use in that questions and answers are supplied. Multiple choice questions are preferred due to the ease of grading this type of answers. In some cases, the materials may need to be modified in order to achieve a sufficient number of mutiple choice questions. Open ended questions are unsuitable for this program. The Barnell-Loft series, for example, contains only multiple choice questions. The length of some of their stories will need to be shortened in order to have time in the session for the questions. Most modifications in both these materials are relatively easy and not too time consuming.

The most important point in choosing reading materials is that the materials must be categorized according to either grade level or age. This is necessary in order to ascertain the degree of difficulty of each story and to provide a means of increasing the level of difficulty as a child's skills improve. It is also important that the lowest level in the series is at least one grade level below the lowest grade score a child receives on the pre-test. For example, in the pilot program all children could read at the 3.0 level and were started on 2.0 level stories, As long as the materials you choose meet these requirements they will be applicable to this tutoring program.

D. Selection of Students

This Remedial Reading Program is designed for students who read at least the 3.0 level, that is, students who have basic reading skills.

Before any tutoring is begun, the children should be given a battery of reading achievement tests. Our pre-testing included the Metropolitan Reading Achievement Test (MAT), the California Achievement Test, and the Gates-McGinitie Reading Test. These tests have been found to be useful indicators of a child's reading ability and seem to correlate with the levels of the standardized reading materials. The pre-test scores are also used to measure the amount of improvement a child has achieved when compared to the scores on the post-tests (using the same testing battery) after the tutoring is completed.

The criteria for selecting children is as follows.

1) scores in pre-test of no less than a 3.0 reading level (many commercially available materials that are graded would be too difficult for children testing below this level).
2) scores no higher than one year above the child's grade in school. (For example: a child testing at the 5.0 level who is in the 4th grade probably could not benefit as much from the program and should not be tutored).
3) no major speech impediments.
4) normal vision
    a. glasses must be worn during tutoring if they have been prescribed.

b. vision testing may need to be obtained if indicated to insure that poor reading is not due to poor vision.

E. Tutoring Procedures

Now that the children to be tutored have been selected it is necessary to organize equipment and materials before the tutoring is begun. Having a specified area for placement of reading materials and supplies will aid in training the tutors and later for efficient tutoring. Also, it is essential that each child to be tutored has a folder where tests, daily sheets, comprehension session sheets and level sheets are kept. In this way, the tutors are able to keep accurate records of the tutoring sessions. Arranging the childrens' folders in alphabetical order in a file cabinet will decrease the possibility of missing or lost folders.

The reading materials must be arranged with a student copy and a tutor copy for each story in each level. The tutor copies must be modified before the tutoring begins. Each sentence of the stories must be numbered and answers written beside the question. For example:

Where did your name come from?[1]
Do you know what it means?[2]
Of course, your name is important
STORY to you because it means you ----
not the boy next door or the girl
across the street.[3] This is a
special meaning ....[4]

What is the main idea?[1]

a) John means "gift".[2]

QUESTION b) many names have two meanings.[3]

c) your name means the boy or girl next door. [4]

ANSWERS: B

The numbering of the sentences, both in the story and in the questions and answers, is necessary for the tutors to record on the sentence accuracy data sheet those sentences the child reads correctly and incorrectly as the child is reading. It would be much more difficult to accurately record this information after a session was completed.

The equipment which will be necessary for the tutoring is as follows:

1) reading materials.
2) sentence accuracy sheets (for tutor use).
3) answer sheets (for student use).
4) pencils for tutor and student.
5) wristwatch, stopwatch or clock to record length of tutoring session.
6) add-subtract counter, cricket clicker, poker chips, bottle caps, etc, (to provide immediate feedback to the child).
7) tape recorder and tape if a record of session is desired.

When the tutoring is initiated, all children selected should be started on the lowest level. Remember: The lowest level is one level below the lowest level a child obtained in testing. This insures that all the children will be able to read the material with relative ease thus creating a feeling of confidence while adjusting to the tutoring procedures. This also allows the children to proceed to the more difficult story levels at their own individual pace. This movement from one level to the next higher level is termed "cycling". A child on level 1 is cycled to level 2 after he has reached our arbitiary criterion of 83 percent correct on the answers for three consecutive session, stories or days. (Refer to section on graphing)

If the children come as a group at a designated time, their names should be recorded in the order in which they arrive and then tutored in the same order. A tutor can then go to the list take the first name, scratch it off, and then prepare the materials for that child. This is done by first getting the child's folder and checking the session sheet for the level of material the child is ready for and the session number. EXAMPLE:

			Answers			Sentences		
Session no.	level	story	total	correct	% correct	total	correct	%cor.
6	I	2	20	15	75	100	80	80

In this case the child would be ready for session 7 using level I material. (See Figure 1). Next a story in that level that the child has not yet read is chosen and marked off on the level sheet that is in the folder. (See Figure 2). This information is then written on the oral reading sheet (Figure 3) and the answer sheet (Figure 4) in the appropriate spaces. It must also be recorded on the session sheet as shown in the example above. (Figure 1). Then, the answer sheet, oral reading sheet, reading materials, etc. are taken to the tutoring room. The tutor then

SESSION SHEET

			Answers			Sentences					
Sess. No.	Level	Story	Tot.	No. Corr.	% Corr.	Tot.	No. Corr.	% Corr.	Tutor	Super. Check	Time

Student ______________________

Figure 1

LEVEL SHEET

Student ____________________ is on Level ________________________________

Cross out each story in column 1 after it is read. When column 1 is filled, start using the stories in column 2. If a story is out, pick another story from that level. BE SURE TO CHECK THE CHILD'S STORY LEVEL BEFORE BEGINNING.

1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
.	.	.	.	.
.	.	.	.	.
n	n	n	n	n

Student ______________ Date ______ Story ________ Session _______

Story Portion				Question Portion											
A				1		2		3		4		5		6	
1	6	11	16	1	2	1	2	1	2	1	2	1	2	1	2
2	7	12	17	2	7	2	7	2	7	2	7	2	7	2	7
3	8	13	18	3	8	3	8	3	8	3	8	3	8	3	8
4	9	14	19	4	9	4	9	4	9	4	9	4	9	4	9
5	10	15	20	5	10	5	10	5	10	5	10	5	10	5	10
B				1		2		3		4		5		6	
1	6	11	16	1	2	1	6	1	2	1	2	1	2	1	2
2	7	12	17	2	7	2	7	2	7	2	7	2	7	2	7
3	8	13	18	3	8	3	8	3	8	3	8	3	8	3	8
4	9	14	19	4	9	4	9	4	9	4	9	4	9	4	9
5	10	15	20	5	10	5	10	5	10	5	10	5	10	5	10
C				1		2		3		4		5		6	
1	6	11	16	1	2	1	2	1	2	1	2	1	2	1	2
2	7	12	17	2	7	2	7	2	7	2	7	2	7	2	7
3	8	13	18	3	8	3	8	3	8	3	8	3	8	3	8
4	9	14	19	4	9	4	9	4	9	4	9	4	9	4	9
5	10	15	20	5	10	5	10	5	10	5	10	5	10	5	10
D				1		2		3		4		5		6	
1	6	11	16	1	2	1	2	1	2	1	2	1	2	1	2
2	7	12	17	2	7	2	7	2	7	2	7	2	7	2	7
3	8	13	18	3	8	3	8	3	8	3	8	3	8	3	8
4	9	14	19	4	9	4	9	4	9	4	9	4	9	4	9
5	10	15	20	5	10	5	10	5	10	5	10	5	10	5	10

$$\frac{\text{No. Correctly Read Sentences \_\_\_\_\_}}{\text{No. Incorrectly Read Sentences \_\_\_\_\_}} \times 100 = \text{Per Cent Sent. Accurracy \_\_\_\_}$$

Student ______ Date ______ Story ______ Session ______ Condition ______

No. Incorrect ______

No. Correct Ans. ______ X 100 = Per Cent Correct ______

No. Incorrect Ans. ______

Session Time ______ Total Responses ______ Rate ______ (Responses/Time)

READING ALOUD % CORRECT ______________________

______ % RELIABILITY ______ WITH ______

SESSION A

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

SECTION B

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

SECTION C

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

SESSION D

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

SECTION E

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

SECTION F

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

brings the child to the room and the session begins. Tutoring usually last 20-30 minutes. Do not tutor for more than 30 minutes. A watch, clock or stopwatch should be used to ensure that sessions do not exceed the 30 minute limit.

How To Tutor

Oral Reading

1. Students read stories and questions aloud.
2. If an entire sentence is read with no mistakes the tutor gives the student one point or chip and circles the corresponding number on the oral reading sheet.
3. If the student makes a mistake in reading aloud, the tutor, immediately at the time of the error, subtracts 3 points or chips, slashes (/) through the corresponding number on the oral reading sheet, and corrects the student.

Types of errors and corrections

a) if the student mispronounces a word, the tutor can help him sound out the word and then say "the word is ________. Repeat the word." After the child repeats the word the tutor should have him reread that sentence.

b) if the student repeats a word the tutor should say, "you repeated the word _____. Read the sentence over."

c) if the student omits a word the tutor should say, "you left out the word ______. Read the sentence over."

d) if the student adds a word the tutor should say, "the word _____ is not in the sentence. Read the sentence again."

e) if the student hesitates for more than 30 seconds the tutor should help him sound out the word and then say, that word is _____ repeat the word." After the child repeats the word he should then reread the sentence.

f) if the student skips a line or sentence the tutor should say, "you skipped a line (or sentence)." And have the child go back to the proper place.

After having made a mistake, if the child rereads the sentence without a mistake he should be given a point or chip. Nothing is recorded on the oral reading sheet at this time because the child had already made an error and that number remains slashed through. It is important that all errors be corrected regardless of how many times a child must reread a sentence before getting it correct. Verbal praise should also be used at the end of a story or after a difficult word or sentence read correctly for additional feedback and reinforcement.

Answering Questions

After the student has read the story he then reads the first question and answers the question. The procedure for tutoring answers is as follows:

1) the student should write his answer on the appropriate blank on the answer sheet and then say it aloud. If the child says the answer but does not write it, the tutor should just sit there or explain that it doesn't

count until its written on the answer sheet. Once an answer is written it cannot be changed or erased.

2) if the student writes a correct answer the tutor adds 1 point or chip and praises the child. For example, the tutor can say, "right," "that's good," "very good," "you're doing well today, " or any thing else that tells the student he's correct. The student then goes on to the next question.

3) if the student writes an incorrect answer the tutor subtracts 3 points or chips, givesthe child feedback such as "that's incorrect," and then instructs the child to find the correct answer. This is done by the following procedures.

   a. If the question asks about something which is answered in the story the tutor instructs the child to go back in the story (a refer back) and find the sentence that answers the question. When the student has found it he is then instructed to put his finger on it and read it (a point out). This can also be done by having the student look for each answer alternative and either say that it's not there or point it out and read it.

   b. If the question asks what order the alternatives are in within the story the tutor instructs the student to go back to the story and put his finger on one of the alternatives, read it, keep his finger on it and then find the alternatives, read them, and then answer.

c. If the question asks what the story is mainly about the tutor instructs the student to, go back to the story, find all the sentences about the first alternative, read them and count them. This is done for each alternative. Usually the alternative which has the most sentences concerning it in the story is the main idea.

These are only examples of questions and tutor responses. The important points are:

1) the tutor instructs the student to go back to the story and point out and read the correct answer.

2) the student points it out with his finger.

3) the student reads the sentence containing the answer aloud.

4) the tutor praises the child for the correct response and adds 1 point or chip.

This system can be used with most questions.

When a child has answered incorrectly the first time the answer remains on the answer sheet and his next answer is written next to it on the same answer blank. The student should never be allowed to erase what's been written. If the childs' secohd answer was incorrect he would be tutored the same as for an incorrect first response and the third answer would be written beside the other two answers. This is necessary for determining which questions were answered correctly and incorrectly.

EXAMPLE: 1 a
2 a b (1 incorrect response)
3 c
4 b c a (2 incorrect responses)

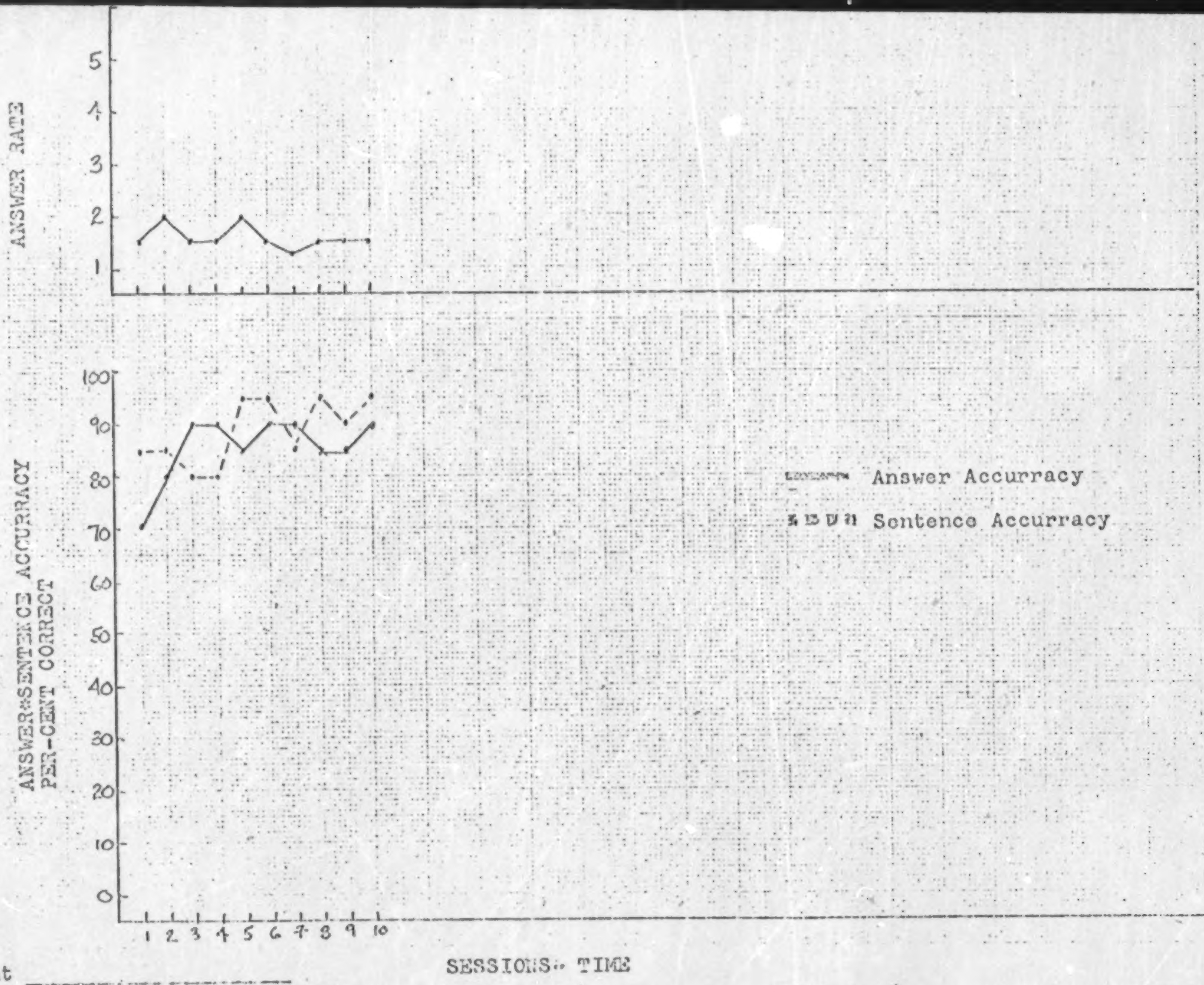
After the tutoring session is completed, the tutor checks the number of points or chips the child has earned and exchanges them for the reinforcement. When using points and money, we found that after the children were used to the system, three points per penny usually earned them between 30 cents and one dollar per day. An arbitrary amount of 25 cents was earned regardless of the number of points. A set minimum that is earned whether it is money or candy will help decrease discouragement and help maintain attendance. After the child has received the reinforcement, he can then be returned to class or allowed to go home.

The tutor must then add up the correct number of sentences read, figure the percentage, and record this information on that page and on the session sheet in the folder (See Figure 3). This is also done with the answer sheet (See Figure 4). All percentages are calculated by dividing the number of correct responses by the total number and multiplying by 100. The sheets are then ready to be checked by the supervisor.

A 5 minute break is then allowed the tutor before beginning the next child.

Graphing and Cycling

Graphing may be done by the tutor who tutored the child but it is perhaps less confusing if done by a person selected and trained for this job. Both the percentage of sentences read correctly and the percentage of correct answers are graphed (See Figure 5). However, it is *only* the *percentage of correct answers* that determines when a child is cycled. Circling in red ink,



Student ____________

Figure 5

those sessions when 83% was achieved on the answers only will aid in knowing when a child is ready to be cycled.

NOTE: A child is cycled to the next higher level when he has earned a score of 83% or above on his answers for three consecutive days.

When the child is ready to be cycled on the next session, the grapher gets that child's folder and changes the level on both the level sheet and session sheet. Having an up to date list of the children on each level taped to the front of the file cabinet where folders are kept is also useful as a reminder to the tutors.

It is important that graphing and cycling be done daily so that the children are tutored at the correct level.

Reinforcement

Reinforcement in the form of point counters, cricket clickers, tokens (poker chips) serve as immediate visual and auditory feedback to the child. Points or chips can then be exchanged for anything, such as money or candy, that serves as a motivation for maintaining reading performance and regular attendance. The reinforcement must be contingent on accuracy, therefore 1 point is given for each correct response and 3 points are subtracted for each error. The reinforcement for reading and answers must be readily available to the children. Field trips, soda pop, or anything else can also be used to maintain the desired attendance. It is important that whatever is chosen as the reinforcement is desireable to the children. In order that the points, tokens, or clicks can be added up the feedback must be tangible. If poker chips are used, they must be put in a box for correct responses and taken out for errors. Electrical add-subtract point counters can easily be used if available. Verbal praise is also important. Praising the child for correct responses paired with the click or token can also serve as a powerful reinforcement.

F. Training of Tutors

Training is started with an explanation of the job. Written instructions of the tutoring procedures and the job description can then be handed out. The tutors are given time to read the procedures and then asked if they have any questions. Even if there are no questions, it may be helpful to read over the instructions with the tutors.

The tutors are then shown the tutoring equipment (tape recorders, stop watches, tapes, etc) and the location of the stories and data sheets. After they are shown where the materials and supplies are kept, they are asked to set up the materials as if they were going to tutor a child.

Next, the tutors are asked to tutor the supervisor as if they were tutoring a child (See Tutoring Procedures). The supervisor provides immediate feedback as to how the tutor is doing in respect to the awarding or penalizing of points, praise, correcting reading errors and incorrect answers, and marking the sentence accuracy sheets.

When the supervisor is confident the tutor has mastered the tutoring procedures, the data sheet calculations are

Job Description: Tutors

1. Be on time.
2. When children arrive choose the name at the top of the list and then scratch it out.
3. Get that child's folder and check level and story.
4. Collect the necessary equipment.
5. Write the information necessary on the session sheet, story level sheet, oral reading sheet, and answer sheet.
6. Set up equipment in the tutoring room.
7. Have the child come from the waiting room to the tutoring room.
8. Tutor the child according to the tutoring procedures.
9. After 30 minutes end the session and reward the child.
10. Escort the child to the door.
11. Calculate the percentages of correct responses on the oral reading sheet and answer sheet.
12. Record the information in the child's folder.
13. Place answer sheet and oral reading sheet at the designated place.
14. Take a 5 minute break.
15. Select a new child.

explained. This usually begins with an explanation of how to use a calculator (if there is one). A calculator is much more accurate than having the tutor perform the division.

The tutor must be shown how to count up all incorrect sentences. To get the percent of correctly read sentences, the number of correctly read sentences is divided by the total number of sentences and multiplied by 100. The same rule applies to correct and incorrect answers. Any question which was answered incorrectly at least once, is considered incorrect. The percent of questions answered correctly is obtained by dividing the number of correct answers by the total number of questions answered and multiplying by 100.

The supervisor should be certain the tutor knows how to compute sentence and answer accuracy correctly, before going any further with the training.

At this point in training, the tutor is ready to tutor the first child. Once again, the tutor should review the tutoring procedures to see if there are any unclear areas. When there are no questions, proceed with tutoring the first child.

While the tutor is tutoring a child for the first time, the supervisor should be either listening, watching or sitting in with the tutor. When the tutor has finished tutoring, the supervisor can then give immediate feedback on tutor performance. This feedback can be in the form of praising the tutor for a job well done, answering any questions the tutor may have, and making suggestions for better tutor performance.

By the time the tutor has worked with a third child, the procedure should become more clear and easier to follow. Even after the tutor has become quite adjusted to the tutoring procedures, supervision should continue in order to maintain effective tutoring.

G. Supervision

In order to maintain appropriate tutor behavior, three supervisory checks have been devised. They are 1) completeness of tutoring 2) accuracy of data sheet tabulations and 3) the time tutoring was begun each day.

For complete tutoring, tutors had been trained to praise the child after each correct answer. While the supervisor listened to a tape of the session, or to the acutal session, what was said to the child was written on the sheet under the heading of "Verbatim". If no praise was given, the supervisor scored the sheet as "no verbal consequences for correct answers" (Figure 6).

Following an incorrect answer, a complete tutor response was defined by three components. The tutor was trained to instruct the child to turn back to the story and look for the correct answer (refer back). Then the tutor should tell the child to look for the sentence that contains the correct answer, put his finger on it and read it aloud (point out). If the tutor did both of these things (refer the child back to the story and have him point out the answer) the tutor was scored as "completely tutoring" an incorrect answer. This procedure was to occur each time a child answered a question incorrectly.

The percent of complete tutoring for both correct and incorrect answers was computed.

Job Description: Supervisor

1) have children write their names on a pad as they arrive.
2) record time begin tutoring for all tutors.
3) have reinforcers available for the children.
4) supervise tutors while they are tutoring and provide feedback with the use of the complete tutor data sheets.
5) check daily calculations and provide feedback to the tutors.
6) supervise graphing and cycling of children daily.

Figure 6

Complete Tutor Sheet

CHECKER

STUDENT

TUTOR

DATE

SESSION

STORY

	CORRECT ANSWERS				INCORRECT ANSWERS								
QUEST	VERBAL CONSEQ		VERBATIM		VERBAL CONSEQ		REFER BACK		POINT OUT		COMPLETE TUTOR		
	YES	NO			YES	NO	YES	NO	YES	NO	YES	NO	
1				1									
				2									
2	✓		"RIGHT"	1									
				2									
3				1	✓		✓		✓		✓		"LOOK BACK... FIND...READ..."
				2									

To obtain the accuracy of calculations measure, the student's percent answer and oral reading accuracy were examined. In order to obtain the student's percent answer accuracy, the tutor was to count the number of correct answers, divide by the total number of questions answered, round off, and record the percent on the data sheet. The same procedure was applicable to the percent of oral reading accuracy.

After all tutoring was completed for the day, all data sheets were re-tabulated by regular checkers and ranked as being with or without errors. To be errorless, the calculations had to be correct. A single error was sufficient to mark the data sheet "with errors". (Figure 7).

The oercent of errorless data sheets served as the second daily performance measure, and expressed the number of sheets classed as without error, relative to the total number of data sheets submitted on a given day.

The last supervisory check was made on the time each tutor began tutoring his first student on a given afternoon. Because each tutoring room was connected to a master-intercom system, listeners had unobtrusive access to obtain the time tutoring was started. Regular observers listened for, and recorded start times on a standardized data sheet. (Figure 8). From these records, the mean time that all tutors began tutoring was computed.

Each day, a tutor's name was randomly selected and his data sheets from a tutoring session the previous day were examined. The tutor's percent of performance scores for each of the complete tutor components, whether or not the child's data sheet contained errors and the time the tutor began tutoring his first child were

Figure 7

Calculation Accuracy Sheet

ANSWER ACCURACY				SENTENCE ACCURACY										
SUBJECTS	NO. RIGHT	TOTAL NO.	%	A	B	C	D	E	F	TOTAL	%	NO ERROR	ERROR	
CAROL BEDFORD	32	36	.89	$\frac{27}{5}$	$\frac{30}{4}$	$\frac{23}{6}$	$\frac{30}{3}$	$\frac{26}{6}$	$\frac{34}{4}$	$\frac{170}{198}$	.86	✓		
MICHAEL FORD	21	24	.88	$\frac{41}{0}$	$\frac{38}{0}$	$\frac{38}{1}$	$\frac{30}{5}$			$\frac{147}{153}$	.96		✓	

NUMBER ERRORLESS: 1

TOTAL NUMBER: 2

PERCENT ERRORLESS: .50

CHECKER:

DATE OF DATA SHEETS: 3/9/72

Figure 8

Time Begin Tutor Sheet

DAY ____________
DATE ___________
RECORDER _____________

TUTOR	ROOM	TIME OF ARRIVAL	MINUTES TARDY	TIME BEGIN TUTOR	TIME SCORE	COMMENTS
V. K.	C	2:07	7	3:35	35	
S. P.	D	3:30	0	3:41	41	
B. C.	E					
G. D.	A					
D.W.	B					

included. The results of the tutor's daily performance were made public each day by means of a feedback board which was centrally displayed in the reading lab.